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POPULAR MECHANICS MAGAZINE

SO YOU CAN UNDERSTAND IT

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TUNE IN!

**Erno Rapee
and the
Mobiloil Orchestra**
of 55 pieces every
Wednesday night
over WEA and as-
sociated NBC stations

We asked:

**"What do you notice first
about the New Mobiloil?"**

Motorists answered:

"It lasts longer"

When the New Mobiloil had been in use several months, we sent investigators to call on motorists in different parts of the United States and Canada. We wanted their unbiased opinion of this new oil.

Our investigators asked: "What do you notice first about the New Mobiloil?" Motorists everywhere answered: "*Mobiloil lasts longer.*"

What is the significance of these three words "Mobiloil lasts longer"? Perhaps they sound unimportant at first glance. But as a matter of fact, they are the most significant words in the science of lubrication. For, in comparing oils of similar "body," engineers have proved that the oil which lasts longest, also lubricates best.

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This is why we can say to you: "The New Mobiloil will keep the first-year feel in your engine, lubricate your engine better—it lasts longer."

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all types of machinery

the New



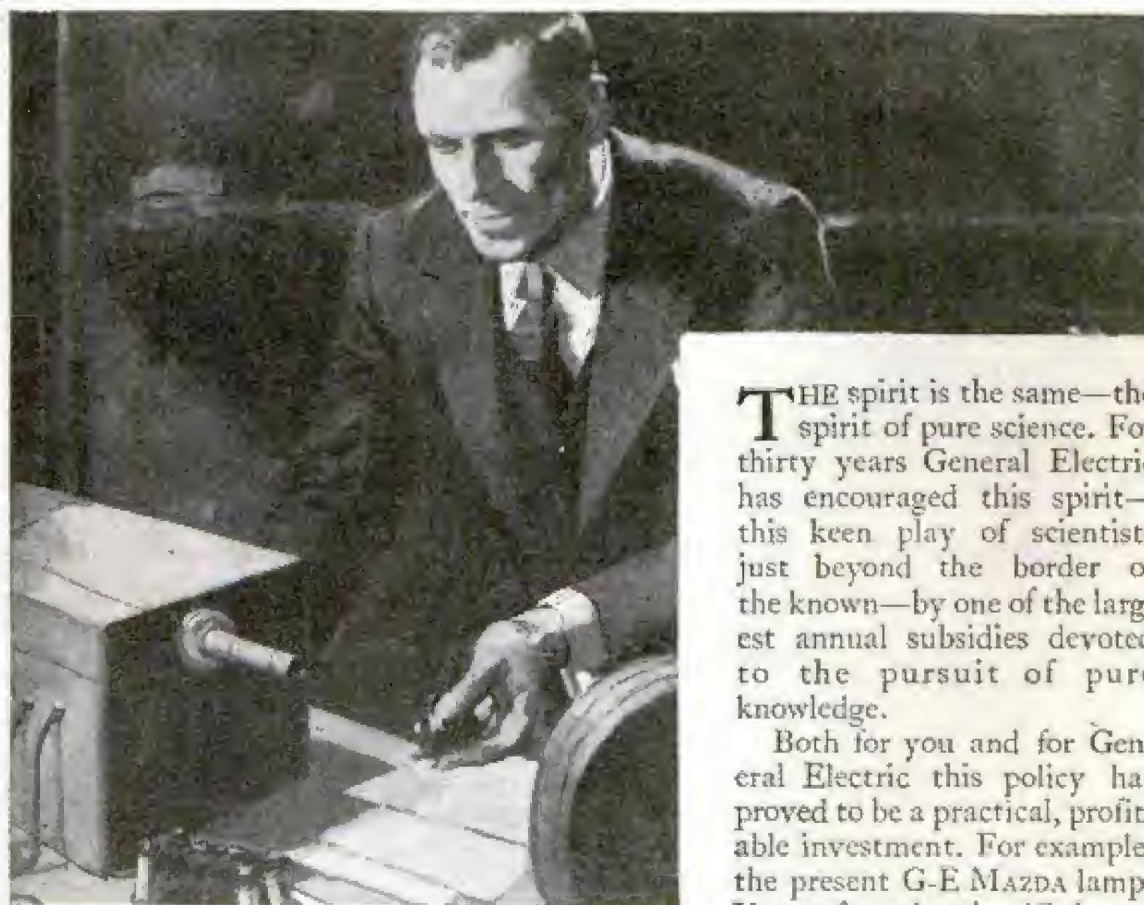
Mobiloil

Keeps the first-year feel in your engine

WHAT MAKES IT TICK?



*The boy takes his birthday watch apart to see what makes it tick. The man listens to the tick of the uranium electrons discharged into space—he actually **hears** the atoms of the metal disintegrate.*



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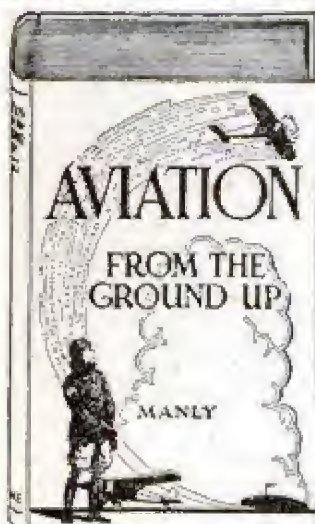
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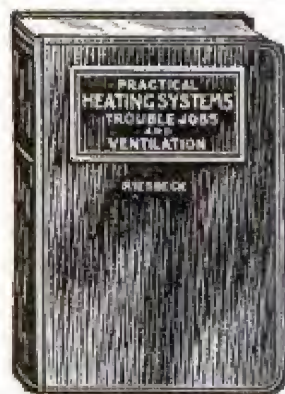
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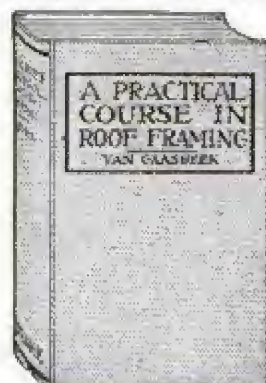
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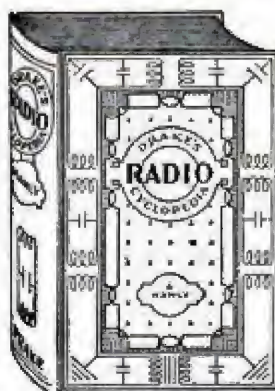
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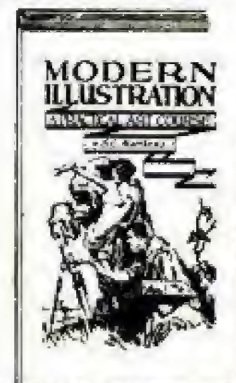
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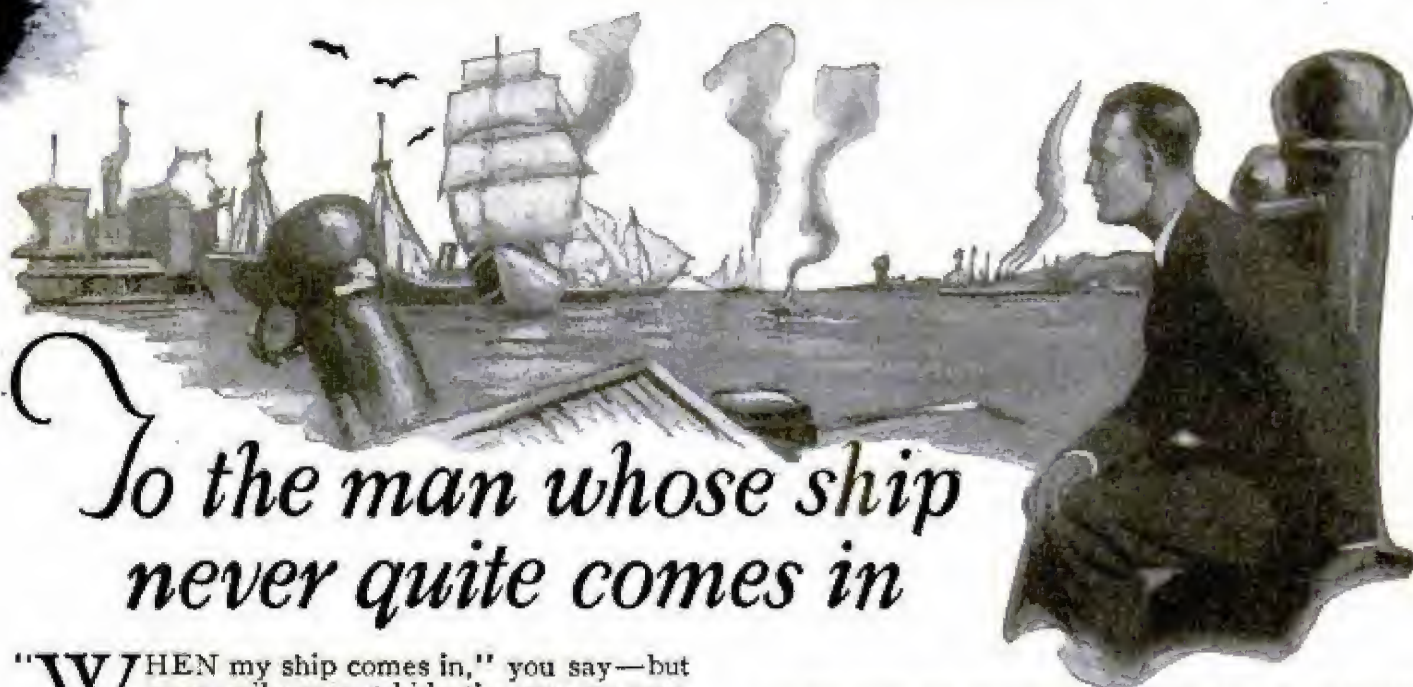
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To the man whose ship never quite comes in

"WHEN my ship comes in," you say—but your smile cannot hide the worry gnawing at your heart—

A fine sea-going vessel you had thought that ship of yours when you launched it on the business ocean—

Yet the days and months and years slip by—and though others see their ships ride triumphantly to harbor, still you scan the horizon anxiously for a ship that never quite makes port.

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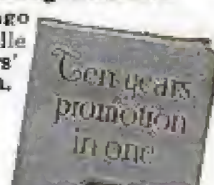
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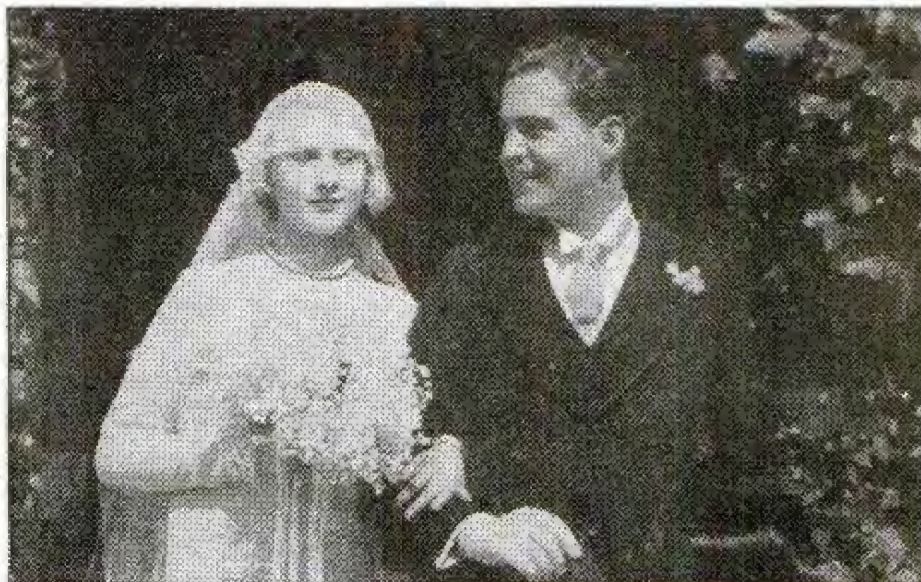
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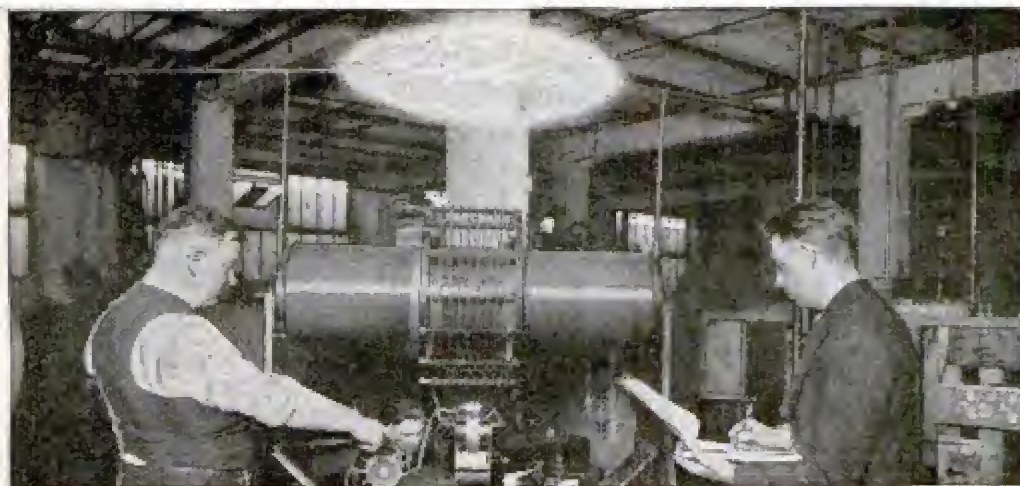
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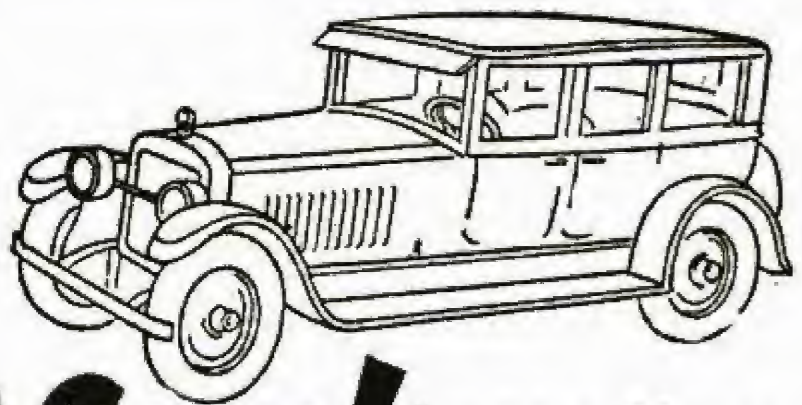
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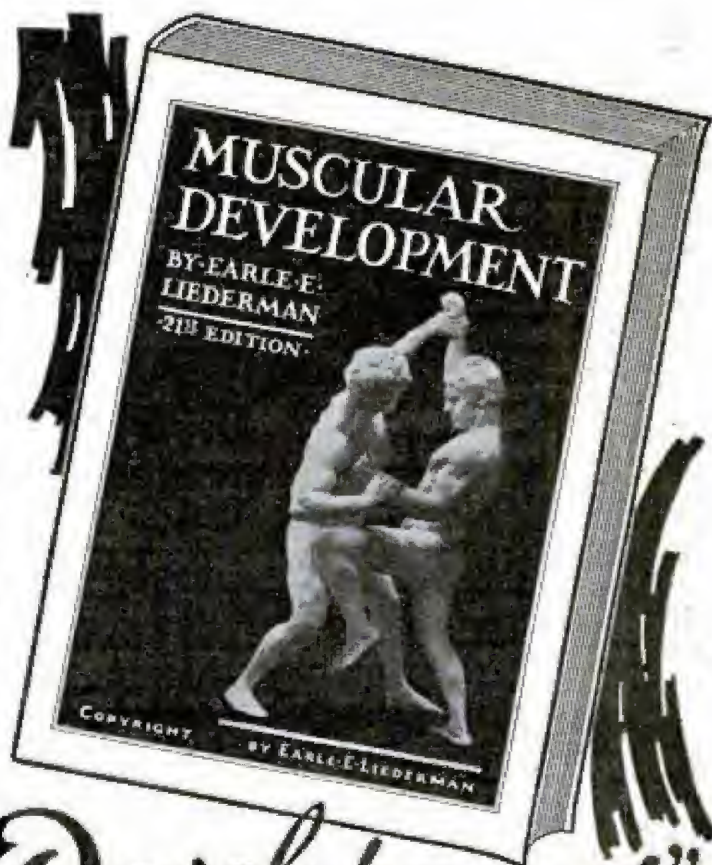
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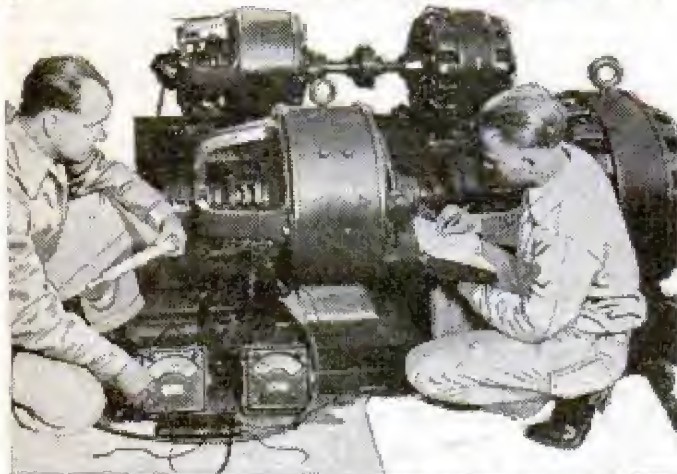
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For example, R. B. Hansen, of Akron, Ohio, is just one case. Not long ago he was a foreman in the rubber-curing room of a big factory at a salary of \$160 a month. One day this remarkable volume, "The Key to Master Salesmanship," fell into his hands. And from that day on, Mr. Hansen clearly saw the way to say "good-bye" forever to low pay, long hours, and tiresome routine! Today he has reaped the rewards that this little volume placed within his reach. His salary runs well into

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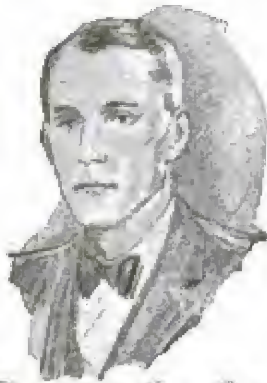
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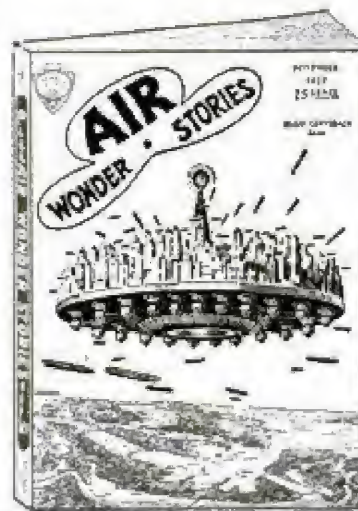
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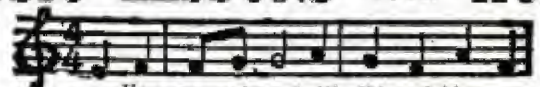
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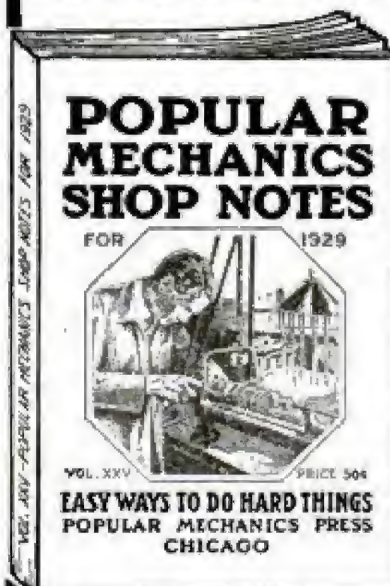
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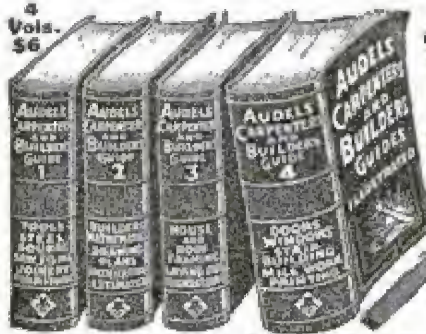
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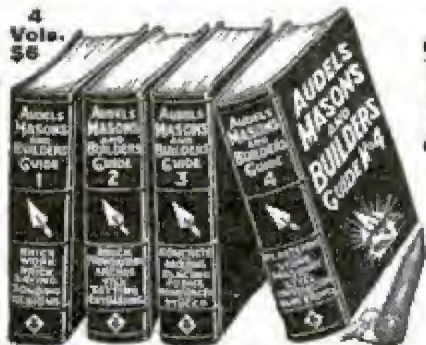
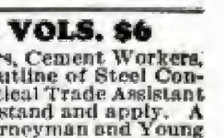
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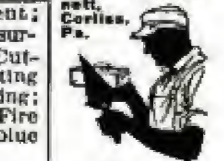
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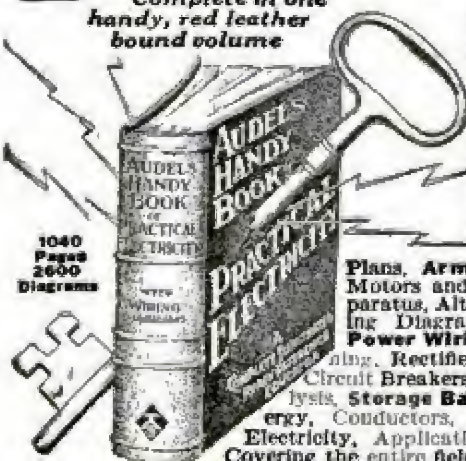
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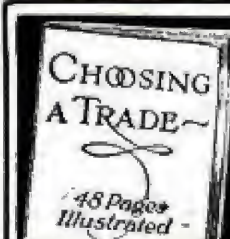
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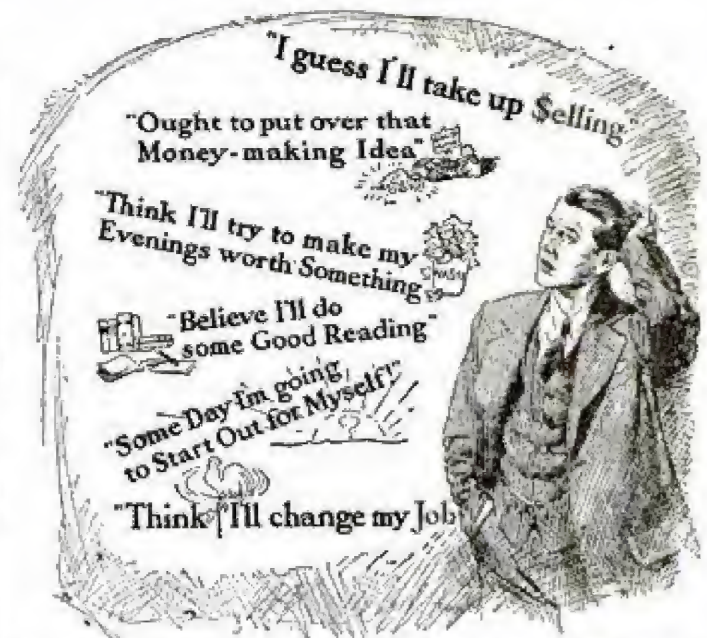
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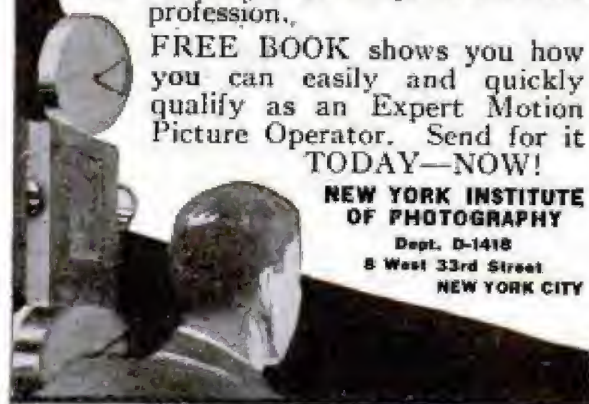
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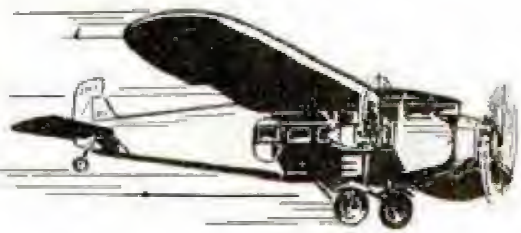
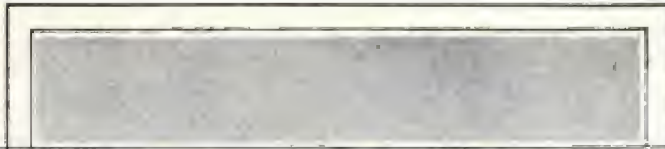
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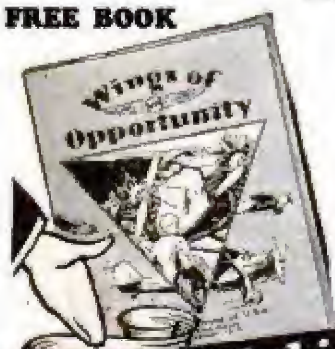
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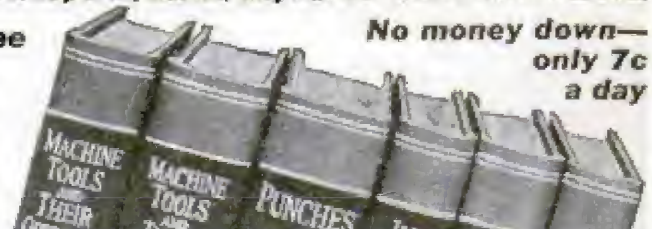
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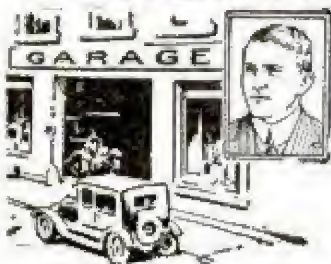
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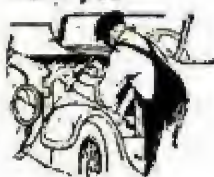
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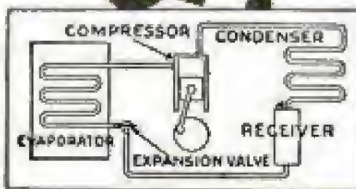
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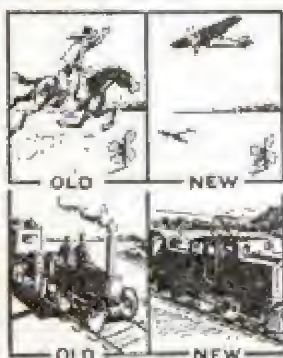
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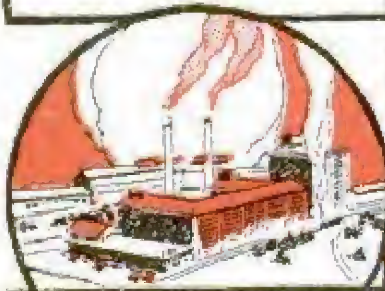
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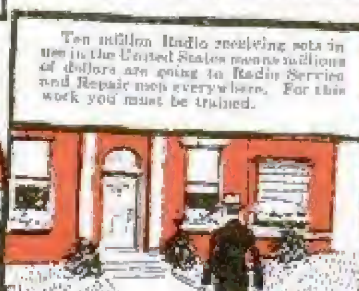
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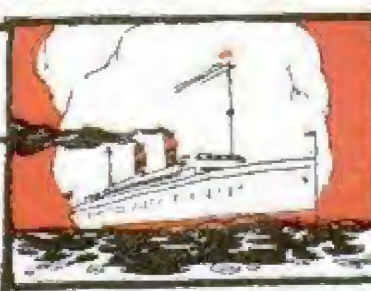
Broadcasting and commercial Radio land station work appeal to a lot of men—it's a big, growing field and fascinating work. My course prepares you thoroughly to get into this field and make good.



Radio manufacturing has grown faster in the last six years than any other big business ever did. It's two hundred and fifty times as big as it was. That means lots of good chances for the trained Radio Expert.



Ten million Radio receiving sets in use in the United States means millions of dollars are going to Radio Service and Repair men everywhere. For this work you must be trained.



Radio operators on board ship go everywhere—do everything. You sail the world over, all your expenses paid, and draw a good salary besides. It's the life of Reilly.

see
coupon
next
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for you in Radio

Learn Quickly, Easily Train at Home In Spare Minutes

Stay home! Hold your job! I'll bring your Radio training to you, and you can learn in your spare time after work. No need to go to a strange city and live for months on expense when you learn my way. You study in the quiet of your own home. As for this training—it's written just as I would talk—in straightforward, every day, understandable language. You'll get it, and you'll get it quickly—in a few months' spare time—because I've made it so clear and interesting! No particular education needed—lots of my successful students didn't finish the grades.

Many Earn \$10, \$20, \$25 Weekly Right Away "On the Side"

Deloss Brown, South St., Foxboro, Mass., made \$1,000 from spare-time Radio jobs before he even finished my course. H. W. Coblenz, Washington, averaged \$45 a week; Leo Auchampaugh, 6432 Lakewood Ave., Chicago, made \$500 before graduation; Frank Toomey, Jr., Piermont, N. Y., made \$833 while taking the course. All this done IN SPARE TIME away from the regular job, while these fellows were still studying the course—and they're only a few of hundreds. As soon as you start this training I begin teaching you practical Radio work. Then a few weeks later, I show you how to make use of it in spare time, so you can be making \$10, \$20, \$25 a week "on the side," all the while you're learning.

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My big book of Radio information won't cost you a penny, and you won't be under any obligation by asking for it. It's put hundreds of fellows on the way to big pay and brighter futures. Sending for it has been the turning-point where many a man has made his start toward real success. Get it. See what it's going to mean to you. Send coupon TODAY!

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Dept. 92P

Washington, D. C.

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Dear Mr. Smith: Kindly send me your big free book, "Rich Rewards in Radio," giving all information about the big-money opportunities in Radio and how you will train me to take advantage of them. I understand this places me under no obligation, and that no salesmen will call on me.

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Hundreds of fine jobs opening in Radio every year

Radio needs more trained men to take care of its rapid growth. Every year there are many fine jobs for men with the right training in broadcasting stations, commercial land stations, Radio factories, with Radio dealers and jobbers, with shipping companies which offer world-wide travel and good pay. Besides there are countless opportunities to have a spare time or full time business of your own.

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Radio's \$5000 and \$10,000 year men of the future will be picked from those who get in now

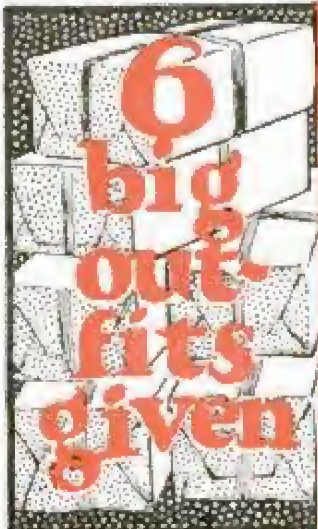
Just as the men who got into the automobile business, the motion picture industry and others at the right time now have the key jobs, so those who get into Radio now, while it is growing fast, will have the first chance at the big jobs. The opportunities that make men rich in other fields are developing right before your eyes in Radio. I will give you the training you need to break in and have a firm foundation on which to build for a successful future.

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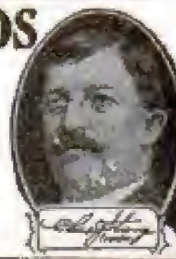
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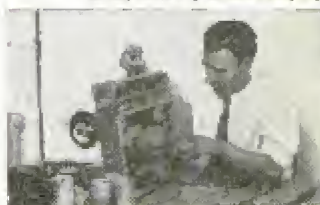
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A transport pilot flying tri-motor planes—working six pleasant hours a day—earning from \$5,000 to \$8,000 a year. Wouldn't you trade your job for his? You can if you only try. With proper training and experience you, too, can become a high salaried transport pilot.

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In addition to flying courses Universal Aviation Schools offer courses in Aviation Mechanics, Aviation Business, and for those who plan to enter aviation later, an Extension Home Study Course in aviation groundwork. Send for outline of training.

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City.....State.....

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Please send.....enlargements from enclosed photo. I will pay postman 49c plus postage for each enlargement. (If 50c each for each enlargement is enclosed with this order, we pay postage.)

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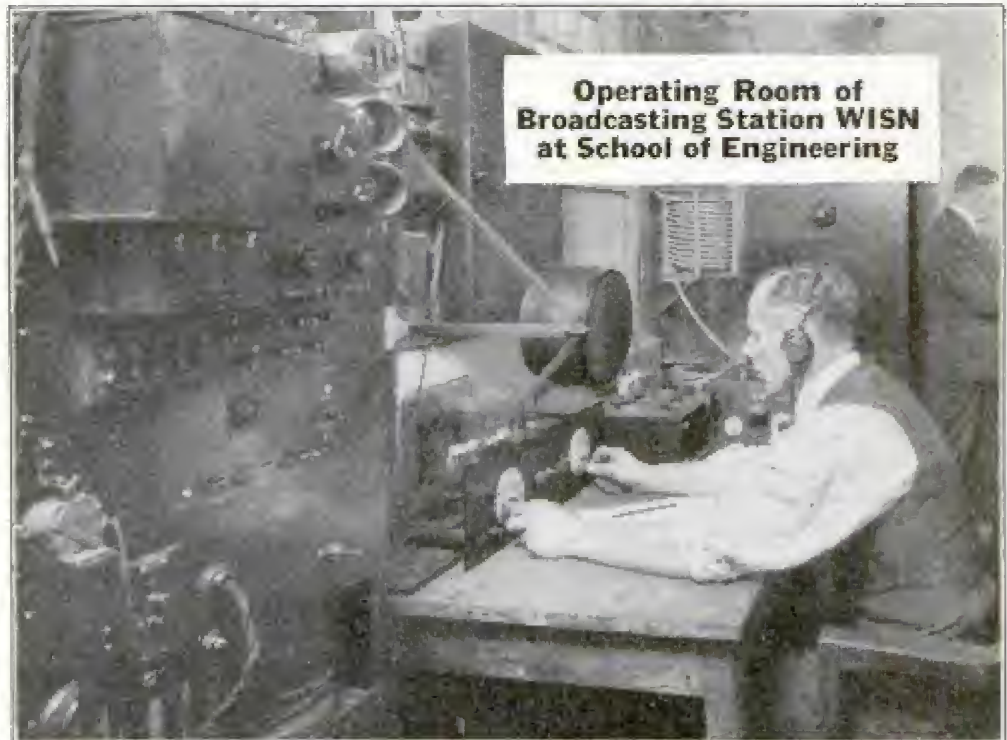
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You Can Be a "Registered" Radio Technician in 90 Days!

Tremendous Opportunities For Trained Men in This Fast Growing Industry

The School of Engineering of Milwaukee, home of broadcasting station WISN and amateur station W9SO, now offers a complete practical 90 days' course in radio to ambitious men. This great electrical school is helping to supply the great shortage of trained radio technicians by giving the most practical training ever before attempted in the radio industry.



Operating Room of Broadcasting Station WISN at School of Engineering

Federated Radio Trade Association Endorses S. of E. Radio Graduates



Read this letter from Michael Ert, Past Pres. of Wis. Radio Trade Ass'n, and now Pres. of the Federated Radio Trade Ass'n:

"We have investigated your Radio and Broadcast Course now being given at the School of Engineering of Milwaukee, and are acquainted with the high quality of educational work you have been doing for years.

Therefore, the Wisconsin Radio Trades Association hereby authorizes you to prepare men to receive Radio Serviceman's Registration Cards, classes A, B or C, of the Wisconsin Radio Trades Association."

The Wisconsin Radio Trades Ass'n now compels every radio service man to pass severe examinations and become registered. Dealers are tired of untrained, incompetent help. Radio trade associations the country over are planning to follow Wisconsin's example. The School of Engineering is the only institution in the country whose course is approved by a radio trade association. Graduates of the S. of E. are "registered."—14 S. of E. men successfully employed by Radio Corp. of America Photophone, Inc.

Most Thorough, Practical Radio Course in America

Here in this big splendidly equipped electrical school (from which Station WISN is operated) you can secure in three months the most thorough, the most compact, practical radio training offered anywhere. Covers entire field of radio! Complete course includes Radio Laboratory Practice, Radio Telephony Theory, Radio Transmission, Code Instruction, Electrical Mathematics, Service and Installation, Radio Sales and Merchandising. Daily broadcasting from WISN. All training is 100% practical. You learn in three short months!

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If you can finance your tuition we will assist you in getting part-time work to help pay living expenses while at school.



Towers of Broadcasting Station WISN on School of Engineering building. This station now being operated by School of Engineering.

Television Included

Complete Radio Course also includes study of fundamentals of Television and latest developments in that gigantic new field. Enables anyone to keep up with progress of this new industry.

FREE BOOK Mail coupon today for copy of catalog describing the S. of E. 90 days' Radio Course and our Earn-While-You-Learn plan. Write now! Classes Now Organizing.

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Founded 1903

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School of Engineering, Milwaukee, Wis.,
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Kant-Slam is different from any other door control. It's not pneumatic, but is built on new oil principle, that controls door like human hand. Gives lifetime service without adjustments. Always efficient in any weather.



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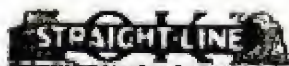
KANT-SLAM DOOR CHECK CO.,
DEPT. T-7, BLOOMFIELD, IND.

GENTLEMEN: Please reserve my territory, and send me full details of your AMAZING FREE OFFER. I am not obligated.

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Address.....

Town..... State.....



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The Ranger Radio is a result of 17 years' development. It is to-day fast becoming the most favorably known radio—now leading the field, as its predecessor, the Ranger Bicycle, has for 30 years.

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PICTURE yourself as THE MAN YOU'D LIKE TO BE.

Picture yourself with the strong, handsome body of an athlete, broad across the shoulders, deep-chested, slim and trim at the waist-line—and covered, from head to foot, with powerful bands of brawny muscle!

Would you like to be reborn into THAT MAN?

"The age of miracles is past," you say. Is it? Send for my wonderful FREE BOOK and see! Read that letter at the right. Then read this letter from Franklin Keyfauber, of Keedysville, Md.

"I feel as if I were born all over again. I no longer remain in the back rows of athletics as I did before writing to you. I am very grateful to you for the muscles I now have and thank you many times."

And read THIS:

"It is impossible to express my gratitude for such a miraculous change in so short a time and to put it mildly, I am just amazed." (Signed) Cederic Dawe, Toronto, Can. And THIS:

"Everyone asks me what I have been doing to myself lately and I just tell them it was Titus who made me over from a weakling to what I am today." (Signed) Duncan Robertson, Convert, N. J.

I could go on for page after page giving you instances like these. I could tell you about men of practically all kinds and conditions, young and old, who testify to the amazing change I have made in them—who tell how they have been freed from their weaknesses. I could show you pictures of men transformed from puny weaklings into powerful, muscular PANTHER-MEN.

But I don't want you to take my word for anything. I WANT YOU TO SEE WITH YOUR OWN EYES WHAT I CAN DO FOR YOU.

Make This 30 Day Test

TRY Titus Training for the next 30 days. See whether YOU feel as if you had been "born over again."

Watch Yourself CHANGE in the Next 30 Days

READ THIS!

John Kohler, Jr., of Windber, Pa., writes: "Gee, I feel great this P. M. I feel as though I could clean up on a herd of elephants, not only wild-cats. I'm born all over again, and the credit goes to you and your apparatus. Worked real hard this month but I don't feel tired as I did at one time. Those days are past. My friends notice my sudden change."

One man writes me that he wouldn't trade the set of muscles I gave him FOR A MILLION DOLLARS. Would YOU? Wait and see!

A Few Minutes a Day and Watch those Muscles GROW

Man, here's a proposition you CAN'T refuse. You've heard about my MIRACLES IN MUSCLES—now see one of them worked on your own body. It will just take a few minutes a day—in the privacy of your own room. Follow my simple, easy instructions. No hard work—just a few minutes a day of FUN. My free book tells all about it—mail the coupon.

Let me show you how I develop every muscle in the human body—how I work on your internal organs, too, to tone and strengthen them—how I charge your whole system with surging energy and vitality.

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Don't send a cent. Without cost or obligation I'm going to send you a book that will open your eyes. You'll be amazed at the wonderful possibilities of scientific body-building, at the speed with which you get RESULTS.

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Please send me FREE and without obligation, Prof. Feuchtinger's new book, "Physical Voice Culture." I have checked subject in which I am most interested.

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**A Genuine Duration
Scale Model**

Very Light and Very Strong

Specifications: Built up model—wood frame. 20 inch wing spread. Fuselage 14 inches. **WEIGHS ONLY SEVEN-EIGHTHS OF AN OUNCE.** This remarkable light weight has never before been achieved in any commercially built scale model of this size. Practically **CRASH PROOF** and has flying qualities galore. The record to date is 92 SECONDS.

You will get new thrills with this newest and finest type model plane. Wonderful results indoors as well as outdoors. Such a light weight, long flying, *real* scale model will be a revelation to you.

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We are offering semi-monthly prizes of five dollars in gold to the one who sends in the best flight record obtained with this model. Full instructions and prize entry blanks are included with every eagle model. Get yours now. The price is low—order your model now and compete for the prize awards. **CONSTRUCTION SET**—Complete with all parts, plans, instructions and prize entry blanks. Postage free. \$1.00.

Eagle Model Airplane Co., North Haven, Conn.

I have received your "Eaglet" kit and assembled it in one day. Hand-launched and hand-wound it never goes less than 150 ft. at about 80 ft. altitude. Yours truly, LEROY BROWN

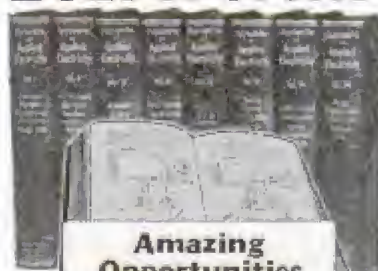
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Name

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Employer's Name

Bald Men Look!

FREE



One Full Ampoule of my amazing Hairerbs fluid which I discovered myself and which grew hair on my head.

Here is How I Used to Look

I was just as bald as this picture. It is a true photograph without any tampering or retouching. It is exactly like I used to look. Then look at the full head of hair I have in the picture on the left!

As I have stated so often, I don't know whether I am the first man who discovered this great secret, but I do know I have it, that I grew my own hair and that I am growing hair on the heads of other men.



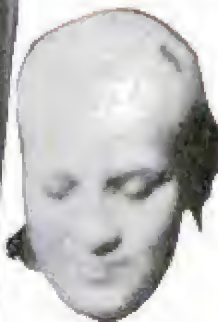
This Ampoule is absolutely free. Don't send any money. There is no C. O. D. No charge whatsoever. All I want is an opportunity to show you the fluid with which I grew hair on my own and on other men's heads. Merely mail the coupon below for Free Ampoule.

Bald Men

It's No Joke to Be Bald!

I grew my own hair just as it shows here.

When the free Ampoule arrives you will see how different this new treatment is.



These are exact untouched photographs of Miss Augustine Raimondo, 2350 East 25th Street, Cleveland, who was almost entirely bald and who had to wear a net covering in the school room. She was a very unhappy young lady. Physicians, hospitals and clinics told her that she would be bald for life. She saw one of our advertisements, became interested and began taking treatments with Hairerbs. The growth of hair was surprisingly fast. A hairy fuzz began to appear after twelve treatments. More hair came steadily until today Miss Raimondo has a full head of hair which is daily becoming more luxuriant. This case is open to investigation by anyone.



What I accomplished on my own head and on other heads I believe I can do for you, provided you are under 45 years of age and loss of hair was not brought about by burns or scars or other causes leading to absolutely dead hair roots. Anyhow, I must succeed or your money is refunded in strict accordance with my guarantee. No apparatus. My home treatment is simple, and easily applied.

Mail this FREE-Coupon

Mail the coupon today—Right Now—I will send you, immediately, one full Ampoule of my marvelous Hairerbs fluid which I discovered, of which I hold the secret and which grew my own hair on my own bald head. Besides the Free Ampoule of Fluid, I will send photographs, names and addresses of men and women who successfully used my Hairerbs Fluid for dandruff, falling and loss of hair.

VREELAND 1359 Euclid-Windsor Bldg. CLEVELAND, OHIO

FREE COUPON

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Ask L. L. Cooke-He'll show you how*



Own Shop Pays Big Money
"You taught me all I know about Electricity. Last month I made \$676 in my new shop." J. E. Ritch, Rt. No. 3, High Point, N. C.



Now Makes \$12 A Day
"A short time ago when I enrolled, I was a laborer at small pay. Now I make \$12 a day. Sure am well satisfied with Cook Training." Robert Korn, 203 S. Maple, Newkirk, Oklahoma.

That's the answer of Fred Girard, Paris, Ark., when friends ask what put him on Easy Street

GIRARD was just like you — just like thousands of other fellows struggling along on small pay—working long, hard hours with no chance for promotion and no hope of big money. Then he got mad at his lack of progress and asked this great Electrical School to help him. Now look at him. He's got a fine job in Electricity—he's making \$100 a week and more—he's on Easy Street with a future that offers him all the good things of life.

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You want quick success — you want Big Pay. Then why don't **you** get into Electricity. Learn like Girard and hundreds of successful Big Pay Men learned — with the famous tried and proven L. L. COOKE "Work Sheet and Job Ticket" Method. It's simple, easy, practical — just like actual shop experience, with the big complete outfit of apparatus given you without extra cost. Yet it's all done in your spare time, in your own home.

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Why earn only \$20 or \$30 a week when hundreds of "Cooke Trained Men" are making \$60 to \$100 a week in Electricity. Investigate. Find out for yourself all about this wonderful Training that has made "Cooke Trained Men the Big Pay Men" everywhere. Mail coupon for Big Free Book that tells all about Cooke Training, about the famous Money Back Agreement, and about the brilliant opportunities in Electricity. Get this Big Pay-Raising Book. Mail the coupon at once.

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GET into advertising. Learn quickly at home. Experience unnecessary. New easy plan. No text books used. Practical work. Old established school. Send name and address for interesting free booklet. Page-Davis School of Advertising, Dept. 3437, 3601 Michigan, Chicago.

ADVERTISE—24 Big Sunday newspapers, 24 words only \$15.00. Excellent for securing agents, salesmen or business opportunities. Catalog listing 1,000 dailies, weeklies, monthlies, mail-order publications, everything. Free. Wade Agency, Great Northern Bldg., Chicago.

INCH Display advertisement 50 magazines year \$24. Wood's Popular Services, Atlantic City, N. J.

ADVERTISE 50 Magazines 5c word; \$3.00 inch; 5,000 country weeklies 1c line per paper; lists free. Evans King Co., 672P, Wilmington, Del.

ADVERTISING: 24 Words 8 newspapers \$5; free list; magazines, farm, trade. Le-Grand Agency, 34 West 33rd St., New York.

BEFORE Advertising get our catalog. No charge. 25 years in business. The largest classified agency in the world. Ankrum Advertising Agency, 100 No. LaSalle St., Chicago, Ill.

FREE—New 1929 Advertisers Rate Guide, 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, 140 S. Dearborn, Chicago.

ADVERTISE in rural weeklies. Lists free. Meyer Agency, 4112 Hartford, St. Louis, Mo.

TIME Counts in applying for patents. See pages 156 and 157. Clarence A. O'Brien, Registered Patent Attorney, Washington, D. C.

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\$50 TO \$50,000 Daily sales secured for our clients. Though physically handicapped this client launched his present business 12 years ago with \$20 borrowed capital. Today his sales are nation-wide. He is a recognized leader in his field. For several years our copy, counsel, plans have served to further increase his sales. 35 years salesmanship-in-print experience back of our campaigns. Submit sales problems for free diagnosis. 10 years Sales Promotion Manager Larkin Co., James C. Johnson, 118A Woodbridge Ave., Buffalo.

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SEND \$1.00 For \$1,000 rural women buyers names. Sheagreen, PM1427 North Penn, Minneapolis, Minn.

LETTER SPECIALISTS

BUSINESS-BUILDING Mailorder letters—circulars—folders—campaigns. Investigated Pinkel Advertising, 131P Glenwood, Jersey City, N. J.

AUTOMOBILES

TIME Counts in applying for patents. See pages 156 and 157. Clarence A. O'Brien, Registered Patent Attorney, Washington, D. C.

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USED Air compressor, fully automatic, upright space saving type, beltless. Reconditioned and guaranteed like new. Shipped on trial and easy terms. Also a few test stands, car washers, battery chargers and paint sprays. E. M. Connor, Box M-1292, Troy, Ohio.

GARAGE. Service stations: Make money with harmless, odorless, non-freezing radiator liquid. Costs 25c gallon. 300% profit. Particulars \$1.00. Froproof, 509 Fifth Ave., New York City.

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AGENTS—To sell electric water heater for \$2.75. New invention. Heats water almost instantly. Real money-maker. Write Lux-Viel Company, Dept. N. Elkhart, Ind.

BIG Money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.34. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 40, East Orange, N. J.

MEN And women. I have two of the biggest money making propositions ever put on the market. \$60 to \$150 week. Write for particulars. Manager, 413 E. 61st St., Chicago.

AGENTS To sell our metal polishing cloth, powdered hand soap, furniture and Ducco polish. Sales Mgr., 1507 East Walnut, Des Moines, Iowa.

AGENTS Cleaning up on pearls and jewelry. Every woman a customer. Write Oriental Pearl, 248 Fifth Ave., New York.

GENUINE Gold Leaf Letters anyone can put on store windows. Guaranteed to never tarnish. Large profits. Enormous demand. Free samples. Write today. Metallic Letter Co., 438-D North Clark, Chicago.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

PORTRAIT Men: Why not Pasco portraits? We refund your money for all you cannot deliver. Frame catalog free. Portrait Agent's Supply Co., Dept. F. La Porte, Ind.

WRITING Ink concentrates. Bottle yourself. Green, blue, red, purple, black. Makes five quarts. Huge profit. Five assorted \$1.00. Texply Color Co., Somerville, N. J.

AGENTS Earn \$6 day. Bonus besides. Auto given to producers when earned. Introduce new guaranteed hosiery. All styles, colors. Finest silks. Credit given. Write for sales plan. Wilknit Hosiery Co., Dept. 231, Greenfield, Ohio.

MAKE \$20 Daily selling merchant's changeable letter show-window signs. Experience unnecessary. Send for free sample offer. Maze Company, 542 W. Washington, Chicago.

STRANGE New electric iron cord! Prevents scorching. Saves electricity. Cannot kink or snarl. Used on telephones also. \$25 daily. Samples free. Neverknot, Dept. 12-A, 4503 Ravenwood, Chicago.

AGENTS Earn \$7 day. Sell finest line guaranteed hosiery. All new styles, big sellers. Big commission. Earn silk hose for your own use. Write quick. Silkknit Hosiery Co., Dept. 1831, Dayton, Ohio.

\$15 DAILY Easily made; great opportunity men and women; experience unnecessary; 50c profit on every dollar. A whirlwind seller. Write quick. Particulars free. E. M. Nelson & Co., West Jackson, Box 324, Jackson, Miss.

SELL Koehler's blue signs. Cost 3c, sells for 20c. Koehler, 717 N. Fourth, St. Louis, Mo.

EXPENSIVE Silk dresses: Slightly handled showroom samples sold cheap for cash. Peddlers, storekeepers, write Mme. Isabelle, P-65 Times Square, New York.

"WORLD'S Greatest auto novelty." Jazz-bird whoopee horn, "A Riot." Sells for \$3. Sample postpaid \$1 or C. O. D. Rico Sales, 166 W. 72d St., New York.

BIG Season on! Winter line ready. Overcoats, sheep-lined coats, leather vests, flannel shirts; men's, women's underwear, sweaters, hosiery. Outfit free. May Co., Paterson Bldg., Chicago.

"WHERE To buy thousands of articles wholesale." New directory. Agents wanted. Pruitt, Brookfield, Ill.

300% PROFIT Selling Mystery Gas Lighter. Retails 25c. Costs you \$1.00 doz. Sample free. Square Deal Mfg., Desk PM2, Bradford, Pa.

CHICAGO Expert valued \$3 stone at \$900. The diamond's only guaranteed rival! Greatest spare time, side-line article ever known! Amazing profits. \$5 pocket sample case free. Write quick! Mexican Gem Company, Dept. PM, Monterey, Calif.

BIG Profits selling our brilliantly colored temporary window transfers to merchants for advertising sales and special events. Complete line arrows, symbols and giant letters. Permanent repeat business. Quick returns. Print-A-Sign, Akron, Ohio.

FOOT-JOY Remedies, appliances. Formula by foot specialist. Proven sellers, repeat business. Relaire Drug Company, Dept. 30, Grand Rapids, Mich.

WELLS Cleared \$820.00 in one month with Business Guide and free legal service. Write for free outfit. Prof. Nichols, Dept. 65, Naperville, Ill.

\$3 TO \$10 Hourly demonstrating amazing door check. Finger-touch shuts all doors silently. No slamming. No broken glass. Keeps doors open when wanted open. Low priced. Big commission. No competition. Quick demonstration sells several to almost every home, office, factory, public institution. Write! Kant-Slam, Dept. TC-7, Bloomfield, Ind.

AGENTS—Men, you can earn \$12 daily wearing felt hats and showing friends. Smartest styles. Latest shades. \$2 to \$5 saving on every hat. Samples free. Taylor Hat and Cap Mfrs., Dept. TC-135, Cincinnati, Ohio.

JUST Out—New kind of electric lamp. 101 lamps in one. So beautiful women can't resist. So useful men buy instantly. Wonderful spare time or full time proposition. Sell C. O. D. or deliver as you sell. Big profits daily. Write for money-making plan. Falcon Mfg. Co., Dept. S-251, 2550 Sullivan, St. Louis, Mo.

TIME Counts in applying for patents. See pages 156 and 157. Clarence A. O'Brien, Registered Patent Attorney, Washington, D. C.

AGENTS—Make a dollar an hour. Sell new kind of sharpeners. Sharpen all knives and tools quickly. Demonstrating sample 10c. Premier Mfg. Co., Dept. 98, Detroit, Mich.

AGENTS: Sell nursery stock. Free landscape service. Wonderful possibilities. Pay check weekly. Write for particulars. Perry Nurseries, R-12, Rochester, N. Y.

MEN Wanted—to demonstrate and take orders direct from motorist. Amazing magnetic trouble light. Sticks on metallic surfaces. Our men earn as high as \$75.00 weekly. Write for demonstrator. Magno, Beacon Bldg., Dept. 109, Boston, Mass.

SALESMEN—Earn \$100 weekly taking orders for dazzler and rainbow glow electric signs. Big commission. Exclusive territory. High grade proposition. Write Chicago Sign Sales Co., Dept. 83, Charlotte, N. C.

AGENTS: Free catalog 200 household specialties, toilet preparations, food products, portraits, frames, photo pillows, medallions, religious goods, pictures. Credit. James C. Bailey Co., Station C-12, Chicago.

CASH Paid for Butterflies, Insects. See Sinclair Display Advertisement on page 26.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

MIRRORS Resilvered at home. Costs near 5 cents per square foot; you charge 75 cents. Immense profits plating autotops, reflectors, tableware, stores, refinishing metalware, etc. Outfits furnished. Details free. Write Sprinkle, Plater, 138, Marion, Ind.

MANUFACTURE Auto Specialties; Radiator Seal, Hand Sump, Puncture Plugger, Silk Life, Glass Cleaner. Get my free list. John Mickman, Chemist, St. Paul, Minn.

MAKE Big money every day. Sell finest work pants and breeches. Every man buys 1 pair at \$1.95, 3 pair for \$5.50, your commission \$1.00. Customer's satisfaction guaranteed. Largest, finest sales outfit free. Write today. Dept. 123, Longwear, 459 Broome St., New York.

\$2.45—RAINCOATS. All colors. Trenchcoats, tweeds, alligators, leatherettes. Sample coat and bonus to workers. Beautiful outfit free. Bradley, Dept. AB-12, 239 S. Wells, Chicago.

REPEAT Orders assured, distributing "Lerdu" rubber specialties; generous profits, needed everywhere; excellent mail order proposition. Particulars free, Lerdu Co., Park Row Bldg., New York City.

400% PROFIT Selling perfumes. Melrose Works, Box 731, Chicago, Ill.

SELL Rhinestone initial belt buckles, etc. Fastest Xmas sellers. Big commission daily. We deliver. Pocket outfit free. Chaton, 666 Blue Island, Chicago.

MAKE More money selling most complete line raincoats, sportcoats, sheeplined coats, leather jackets and tablecloths. Latest styles. Lowest prices. Highest commissions. 7x5 Scratch line free. Jeffrey, 716 Madison, Chicago.

CHURCH'S New lacquered steel drip caps stop rain coming under doors. Dozen complete \$3.50 postpaid. Sample 50c. Sells \$1.50 each. E. L. Church Co., Whitman, Mass.

AGENTS—Men and women with or without experience can sell our superior line of toilet and household specialties, combination bath sets, etc. Big profits. Full particulars on request. Dept. 22, W. C. Johnson Co., Atlantic Highlands, N. J.

MAKE \$20 To \$35 a day selling Imprint Book Matches, spare or full time. Big repeat business—no investment—every merchant a prospect. Send 50c for selling outfit which includes complete samples. Imprint Book Match, Dept. 119, 377 Melgs St., Rochester, N. Y.

\$5.00 To \$15.00 Daily. Represent leading manufacturers. 1,000 immediate openings all territories. Salesmanager, 18 E. 12th, Dept. E, Cincinnati, Ohio.

WANT More mileage? Wonderful new humidifier (moisture) gas saver. All autos. One sent for test. Vix, RO-805, Wheaton, Ill.

FREE Booklet describes 47 plans for making \$20-\$100 weekly in home or office business of your own. Elite Co., 84 Elizabeth St., New York.

FREE Booklet describes 57 plans for making \$20-\$100 weekly in home or office business of your own. Elite Co., 84 Elizabeth St., New York.

AMAZING Screw-holding screw driver! Factories, garages, workers buy on sight! Profit 75c each. Exclusive territory. Free trial offer. Jiffy, 1273-B Winthrop Bldg., Boston.

100% PROFIT Selling watches. Agents, make over \$15 daily selling men's watches. Write how to get sample watch free. Guarantee Watch Co., 119-P Nassau St., New York.

MAKE—Sell your own goods. We tell you how. Formula catalog free. Clover Laboratories (PM), Park Ridge, Ill.

AGENTS Buy hosiery direct at lowest mill prices. Men's heavy silk and Rayon hose, doz. \$2.25-\$3.50; men's latest fancy hose, doz. \$1.45-\$2.19; ladies' Pointex silk hosiery, doz. \$4.25-\$7.00. Satisfaction guaranteed. Act today. Superior Knitting Company, Dept. 31, New Haven, Conn.

ABSOLUTELY Unequaled window attraction, used by thousands of merchants, offers exclusive permanent opportunity. Big commissions, dignified selling, unbiased prospects. Splendid sales materials free. The Illustranew, 511 Chapel St., New Haven, Conn.

AGENTS—New style tablecloth. No laundering, hemstitched, flannel back, several colors. Sells itself. Samples free. Puritan Mills, 43 Tremont St., Boston, Mass.

AGENTS Earn \$8 day. Sell finest line silk hosiery you ever saw. We furnish auto when earned. Earn silk hosiery for your own use. Write today for sales plan. Betterknit Hosiery Co., Desk 5431, Columbus, Ohio.

CHRISTMAS Cards. Box 21 cards, 21 fancy-lined envelopes. Sells \$1. Large profit. J. Springer, Room 665, 1440 Broadway, New York.

INSTANT Hot water from light socket. Specialty salesmen, crew-men, agents say: "It sells itself—it's an Oil Well." Also fieldmen organizing. Salesmen and women demonstrators wanted everywhere. All or spare time. Work at home or travel. Experience not necessary. Good pay. Send stamp for particulars. Dad's Factories, Indianapolis, Ind.

PHONOGRAPH Needle plays 50,000 records. \$2.50, profit \$1.25. Excellent sideline. Smit, 3605-D, Kingsbridge Ave., New York.

\$100 TO \$200 Weekly selling new useful article wanted by every home and business. K. K. King, Michigan City, Ind.

LET Us send you free folder explaining 67 money making plans, home office. Raphael Co., 122 West 94th, New York.

AGENTS—Shoe sales for ten cents. Spreads on with knife like butter. Waterproof, pliable and wears like leather. Write for big money making proposition and no cost sample. Universal Laboratories, Inc., Dept. 502, Des Moines, Iowa.

80c PROFIT On \$1.00 sale! Splendid cleaner for automobiles, furniture, metal and glass. Your name on label assures you all repeat business. Appoint your own agents and dealers. Earn \$25.00 daily. Exclusive territory. Free sample. Minute Kleen Laboratories, Dept. E, Evansville, Ind.

TOP Seller!!! Christmas! Beautiful toilet goods assortment at \$1.50 with 25 inch pearl necklace free to your customers, 100% profit. E. M. Davis, 238 North Ave., Dept. 330, Chicago.

\$8.00 DAILY Selling lingerie. Exclusive designs. Fashioned at Naam Shoppe, 1415 U St. N. W., Washington, D. C.

PORTRAIT Agents! Handle "Viking Brand" portraits. They deliver and satisfy. Beautifully finished. Likeness guaranteed. Lowest prices. Viking Portrait Co., 20 West Jackson Blvd., Chicago.

SELL Housewives something they want. A necessity. Reduces gas bills 25%. New in your territory. No competition with this guaranteed gas saving device. Exclusive sales rights 400% profit. Box 18E, East San Diego, Calif.

\$20 DAILY, Showing \$2.98 trench coats, also Dupont's launderless tablecloths; garment bags. Samples free. American, 726-MH Roosevelt, Chicago.

\$5.00 HOURLY. Mercetized damask scalloped table cloths. Size 58x58", 75c! Tremendous demand. Other bargains. Big sample line free. American Braiding, AM-418 S. Wella, Chicago.

WONDER Hotpad invention paying \$18.00 daily. Banishes water bottle and electric pads. Sales helps. Experience unnecessary. Free sample offer. Applicator Corporation, 3357 Cottage Grove, Chicago.

EARN More. Valuable book teaches. Literature free. Brookins, Warren, Ark.

VENDING Machine men—Grab this! \$12.50 commission every call! New, different, low priced, whirlwind seller. Act quick. Postal Confection Mfg. Co., 2033 W. Charleston, Chicago.

STIK-TITE Slacks rubber, leather, soles, heels on shoes, boots, rubbers. Use old inner tubes, tires. Outwear leather, cost nothing. No cement. No nails. Waterproof. Guaranteed outfit 35c. Distributors. Agents. Exclusive territory. Wonder Products Co., 3617 Chmarron, Los Angeles, Calif.

CAN Opener. Made for service; easily operated; does neat job; long life. Good seller. Write for price to agents. Western Wrench Co., 8427 South Chicago Ave., Chicago, Ill.

MAKE \$2.00 Every hour. Sell every home wonderful preparation; mends hosiery, clothing without sewing. Invisible. Results guaranteed. Send for free sample of work. Queen City Lab., Dept. PM-12, Cincinnati, Ohio.

GO In business for yourself and sell our home motion picture equipments on commission. Write National All-Movie-Sales Co., 333 N. Michigan, Chicago.

DON'T Sell for others—Employ agents yourself. Make your own products. Toilet articles, household specialties, etc. 500% profit. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

AUTOMATIC Hand power nut cracker. Fast, accurate. Two models, \$8.50-\$9.00. Agents can clean up. Clarks Nut Cracker, Harrisburg, Pa.

STOP! 400 Fast selling specialties from many parts of world. Write for free wholesale catalog. See ad page 187. Sports Co., Lesueur Center, Minn.

ARTICLES Of merit. Repeat sellers. Big profits. For information write Lightning Products Co., 616 W. Kinzie St., Chicago.

SELL Holiday Greeting Checks. Something different. 200% profit. Sample free. 3330 Telegraph, Oakland, Calif.

EMBOSS Signs. Something new. Going big. Ten cents for two samples. Signs, 3328A Telegraph, Oakland, Calif.

AGENTS—Speed filter. Guaranteed filter beverages crystal clear, one gallon minute; new invention. Sparkler Mfg. Co., 448 West Grand, Chicago.

DON'T Sell for others—Employ agents yourself. Make your own products. Toilet articles, household specialties, etc. 500% profit. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

BIG Money weekly year round appointing agents. No canvassing, delivering or investment. Mother Hubbard Foods, 534U Congress, Chicago.

A REAL Money-maker. Sells everywhere. Metal polish in tubes. Trial tube free. P. M. Reid, 1419 Clark, St. Louis, Mo.

GET Into aviation! Earn \$35 to \$100 weekly. World's fastest growing industry. Factories and airports need trained men. Unlimited future. Learn in spare time. Amazing home study method qualifies you in few short weeks. Personal, Practical help of veteran world-war flyer. Employment help free. You must be over 18. Rush name, address for special tuition offer and illustrated book free. Write Major Rockwell, Dayton School of Aviation, Desk SC-1, Dayton, Ohio.

\$10-\$25 DAILY Simply showing new Polly wrench. 10 wrenches in one. Guaranteed seller. Sample free. Gellman Mfg. Co., Dept. 6K, Rock Island, Ill.

AGENTS Wanted—Practical and most used necessity of the present day. Sold on a money back guarantee. The Ex-Ton Company, La Salle, Ill.

GREATEST Opportunity; newest proposition. Build continually paying business in your own name. Household, industrial, brushes, brooms, mops, dusters, fully guaranteed. New catalog, all net prices, no discounts to bother with. Make as high as 300 per cent and over. Write today. Wire Grip Sanitary Brush Corp., 41 East 11th Street, New York.

AGENTS "Strike a gold mine" selling Nulastro cloths at 25c; cleans, polishes all metals; the duller the metal, brighter it shines. One agent sells 102 boxes in 116 calls. Write for free samples, particulars. Shet Mfg. Co., 20 Shafes Bldg., Weehawken, N. J.

AGENTS—Sterling's "Anti-Freeze" keeps frost off windshield. Sample 50c. Sterling Laboratories, Cedar Rapids, Iowa.

FAST Seller—Big profits. Every housewife, automobile owner, etc., will buy "Kwick Kleen" for windows, mirrors, furniture, store fixtures. Sample 35c. Sales plan free. Sterling Laboratories, Cedar Rapids, Iowa.

NO Dull times selling food. People must eat. Federal distributors make big money; many over \$3,000 yearly. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license, sample case and free samples for customers. Repeat orders sure; exclusive territory. Ask now! Federal Pure Food Co., A2307 Archer, Chicago.

ENGRAVED Name plates, signs, numbers, desk plates, store window signs, etc.; profits large. Brett Bros., Winthrop, Mass.

SELL Stores in candy specialties. 100% profit. Lorrac Products, Albany, N. Y.

WANT Distributing agent for Hanslick, powdered handsoap; removes anything from the hands without injury to skin; everybody a customer; great opportunity for hustler to get in business; sample free. Solar Products Co., J2144 So. Troy, Chicago.

BIG List of Christmas seasonal Greeting cards, combination toilet sets, perfumes. More than 400 items. Details free. Write! Togstad Co., 30 Punion St., Kokomo, Ind.

SELL Complete line household brushes. Send for free catalog and sample case offer. National Brushes, St. Louis, Mo.

PHOTO Medallion men and women, the largest line of photo novelties in the world. Lowest prices, quickest service. Send for catalog showing over 200 money makers. Photo medallions, photo medallion clocks, photo mirrors, photo fountain pens, photo powder compacts, photo jewelry and photo buttons. Gibson Photo Jewelry Co., 608-614 Gravesend Ave., Brooklyn, N. Y.

AGENTS—Moss Corn and Callous Remover will build you a steady repeat business. Send today for pocket-size trial outfit. The Moss Company, 442 Searle Bldg., Rochester, N. Y.

BIG Money applying gold initials on automobiles. Easiest thing today. No experience needed. \$1.45 profit every \$1.50 job. Free samples. "Baken," X-1043 Washington, Boston, Mass.

HIGHEST Surprise offer ever made. Be sure to answer this ad. My line of soaps, coffee, tea, spices, toilet articles, household specialties, pays you bigger profits. M. G. Roth, President, 2716 Dodder, St. Louis, Mo.

SUCCEED With your own products. Make them yourself. Formulas, processes, trade-secrets. All lines. Catalog, circulars free. R. Thaxly Co., Washington, D. C.

SELL Men's neckwear—wonderful proposition. Anor-M, 39 East 25th, New York.

REMNANT Store, Bethel, Ohio. Greatest Dry Goods Bargains on Earth. Agents and Dealers.

MONOGRAM Automobiles. \$1.35 Profit ten minutes' work; every owner wants them; millions without; particulars free. Motorists Accessories Co., Mansfield, Ohio.

START An honest-to-goodness, successful-paying business that's yours. Making world's greatest sellers! Investment small. Profits great. Start anywhere. Get my valuable "eye-opening" literature about specialty manufacturing—How you can easily make guaranteed exclusive automobile specialties, including wonderful Loidlac, finest household cleaners, best soaps, high-grade toilet preparations, modern insecticides, delicious food and beverage lines fastest-selling carded specialties. 32 years unequalled reliable service. Miller, Chemist, 708-J Chemical Building, Tampa, Fla.

"HOW To Secure Agents," a specially prepared booklet, tells of one of the most inexpensive methods in which to secure good live producing agents. It is free; write for your copy today! M. L. Rund, Mgr. Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.

DON'T Sell for others—Employ agents yourself. Make your own products. Toilet articles, household specialties, etc. 500% profit. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

SELL "Prevents Runs." Guaranteed to prevent runs in silk hosiery. Large profits. Particulars. Specialty Mfg., 307A West First, Los Angeles, Calif.

AGENTS—Make a dollar an hour. Sell Mendets, a patented patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 404, Amsterdam, N. Y.

GOLD-LEAF Window letters and script signs; no experience; 500% profit; samples free. Consolidated, 69-T West Van Buren, Chicago.

GET Our free sample case—Toilet articles, flavoring and specialties. Wonderfully profitable. LaDerma Co., Dept. A, St. Louis, Mo.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name and address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., Desk 2, 303 Degraw St., Brooklyn, N. Y.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

THAXLY Formulas produce perfect products. All lines. Catalog free. B. Thaxly Co., Washington, D. C.

POLMET Polishing Cloth removes tarnish from metals without the use of liquid, paste or powder. Our agents say it sells like "hot cakes." Retail 25c; sample free. Gale & Co., Inc., 15 Edinboro St., Boston, Mass.

32 SECONDS Complete tire change by Detmer, Ohio, with Morey Quick Action Rim Tool. Sold, singly, 49 three days cleared \$100. Anderson, Mont., sold 1,400 in 14 weeks. Get details for good territory. Harvest time now. M. Morey Rim Tool, Buffalo, N. Y.

NO Matter what you are selling postal addressed to Excelsior Sales Co., Shreveport, La., will bring best money making offer you ever received.

AGENTS—New shirt proposition. No capital or experience needed. Commissions in advance. Samples free. Madison Company, 566 Broadway, New York.

AGENTS Wanted—On a fast selling 25c item for the kitchen, costs you 8 1-3c. Sample sent parcel post prepaid for 10 cents. P. Seed Puffer Mfg. Co., Inc., 353 Broadway, New York.

AUTOMOBILE Specialties. Guaranteed formulas for all latest money makers. Lowest prices. Write for free lists. Murphy, Chemist, Tulunga, Calif.

FLAVORING Extracts—Bottle yourself! Concentrated. Free labels. 600% profit! Whirlwind moneymaking proposition! Write Thomas Manufacturing Company, Indianapolis, Ind.

MAN in each town to plate auto parts, reflectors, bathroom fixtures, refreshment mirrors, chandeliers; by new method. No capital or experience required. Simple plan of manufacturing at home starts you in big money-making business. Outfit furnished. Free particulars and proofs. Gun Metal Co., Ave. H, Decatur, Ill.

REPLATE Brass worn-off automobile parts, reflectors, bath room fixtures, worn knobs, forks, etc., with pure silver. Looks like new. Use U-Kan-Plate Polish. Post paid. Satisfaction guaranteed. Agents wanted. Dept. A, U-Kan-Plate Co., Philadelphia.

A BUSINESS of your own—Making sparkling glass name and number plates, check-boards signs. Big book and sample free. Write for details. Boston, Ohio.

BRANDNEW 50c Specialty, 150% profit. Quick demonstration sells every housewife. Pocket sample. Deliver on spot. Great sideline. Agents, distributors cleaning up \$65 to \$124 weekly. Territory going fast. Write today sure. Barker Specialties, Battlecreek, Mich.

\$12.00 DAILY Showing new table cloth. Looks like linen. Wash like oilcloth. No laundering. You just take orders. We deliver. Pay daily. Sample free. Bestever, 152 Irving Park Station, Chicago.

\$75 WEEKLY Up placing Aspirin, Notarar, Lighter Flint, Silk-Tone and other self-selling counter display cards with merchants, soda fountains, cigar stores, etc. Over 100% profit. Steady repeats. Sterling Company, F. Baltimore, Md.

AGENTS—Clever Invention! Inkspoon makes every pen a fountain pen. Fast office seller; big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marui Company, Tribune Bldg., New York, N. Y.

TWO Money makers for agents. "Francia" Pocket Adding Machine retails \$1.85. To you \$1.00. "Excaligraph" Rotary Stencil Dupliator \$37.50 retail. Write Typewriter Supply, 102 Hersch Bldg., Pittsburgh, Pa.

WE Start you without a dollar. Soaps, extracts, perfumes, toilet goods. Experience unnecessary. Carnation Co., 641, St. Louis, Mo.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

CALIFORNIA Perfumed beads selling like hot cakes. Agents coinng money. Big profits. Catalog free. Mission Factory P, 2328 W. 11th, Los Angeles, Calif.

BIG Profit! Fast sale! \$9.75 automatic washing machine. Guaranteed. Write Storm Royalty Co., 3901 Enright, St. Louis, Mo.

\$60-200 A WEEK. Genuine gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

HIGH GRADE SALESMEN WANTED

BIG Free printing line brings easy quick profits. Union label. Bigger commissions—up to 55%! Experience unnecessary. Now write orders with America's most profitable printing stationery line. Thousands of free cuts. Over 150 standard items covering every business need: letterheads, noteheads, envelopes, billheads, business cards, statements, garage forms—shipping, battery, dry cleaning, tire, storage, parking and hat-cleaning tags; repair forms, blotters, gummed shipping, drug, advertising stickers, etc. Lowest prices. Steady repeat orders. Ship everywhere. New free outfit just off press. Write quick. Dept. 175, Box 498, Cincinnati, Ohio.

OUR Men actually earn \$300 to \$500 selling our line. Adelle, the newcomer in electric window salesmen, is making a big hit. More for the money. Business posters for every line. Changeable letter system too. Permanent business for you working with us. Territory protected and repeats credited. Fat commissions. Full details prove very interesting. Display Products, Ltd., 409-A East 31st St., Kansas City, Mo.

REPRESENT Leading manufacturers in your community. Big earnings. No experience required. Get the facts about this unlimited field. Write for free copy of Opportunity Magazine, Address 7508A No. Michigan, Chicago.

A SIDELINE That pays 40% advanced commissions. Biggest line illustrated printing for all businesses. No experience needed. Selling outfit free. Hillside, 1217 Van Buren, Dept. 30, Chicago.

EARN \$20 A day. Establish income for life selling for \$1 a year, \$1,500 accident policy. Write W. C. Stone, 11 So. LaSalle, Chicago.

POOL Shooter, new fascinating vending machine. Merchants everywhere buy! Splendid sideline. Big profit maker! Free pocket outfit! Specialty Mfg. Co., 6617 W. Division, Chicago.

GALLOPING Ivory: New game that's thrilling all America. Absolutely legal. Every cigar counter waiting for you. \$125-\$200 weekly. Hurry. K&S, 4308 Ravenswood, Chicago.

\$282.80 COMMISSION On a \$10.50 original sale. Every merchant a prospect. Absolutely new and different. Exclusive territory. Sales Stimulators, 339 W. Madison, Chicago.

SIDELINE To merchants, drug stores, garages. Repeat business. Corona, Box One, North York, Va.

TAKING Country by storm. Odorless deodorant. Personal uses, Halitosis to foot odors. Household uses, refrigerators to toilets. Powder concentrate hundred times cheaper than any ready-mixed competitor. Amazing repeater. Save time. Send dollar for postpaid dollar bottle and dollar can. Satisfaction guaranteed. Exclusive territory. long discounts, big volume profits. Central Products, 2029A Bellevue, St. Louis, Mo.

SALESMAN—Traveling, to sell new D-Nite electric celluloid changeable letter signs. Men earning \$125.00 per week. Write at once for interesting proposition. Elwell Sign Co., 201 W. Carroll St., Macomb, Ill.

STEADY Income to mechanically inclined salesman with car, selling guaranteed line socket wrenches and other time saving tools. Every mechanic live prospect. Liberal offer. York Co., Dept. PM212, 2040 Greenview, Chicago.

SUCCESS Is no accident! You will fully understand this slogan when you examine our automatic credit and collection plan. Copyrighted, brand new, unusual, 250% on original sale. Half cash on repeats without callbacks. Commonwealth Publishing, 508 So. Dearborn, Chicago.

BUSINESS Stationery—Largest line, highest quality, quickest delivery. Biggest commissions; liberal bonuses. Free copyrighted cuts every business. Experience unnecessary. Instructions and outfit free. David Lionel Press, 312 S. Hamilton, Dept. 114, Chicago.

HOW About this winter? Does your present connection offer you the money you want to earn this winter? We can show you how to earn \$50 to \$100.00 weekly. Are you interested? Write Geographical Pub. Co., 621 Plymouth Court, Chicago.

DON'T Sell for others—Employ agents yourself. Make your own products. Toilet articles, household specialties, etc. 500% profit. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

MAKE Your own products. Employ agents yourself. Toilet articles, soap, extracts. We furnish everything. Valuable book free. National Scientific Laboratories, 1935 Broad, Richmond, Va.

PAYING Position open. I'll put you in the shoe and hosiery business. Permanent income, protected territory, full commission on repeats. Experience not necessary. Handsome sample outfit, literature—everything you need to become a successful shoe merchant. Send for free booklet "Getting Ahead." Wm. J. Misher, Tanners Shoe Mfg. Co., M. 20012 C St., Boston, Mass.

OUR proposition is interesting. What and where have you been selling. Neverbreak Tools, Box 304, North Canton, Ohio.

TOOL Salesman—Now selling auto mechanics, garages and service stations, to sell modern brake tester recommended by leading automobile manufacturers. Give experience, lines now selling, territory covered, etc. The Kelley & Stewart Co., So. Brownsville, Pa.

SELL "Union Label" business stationery. Lowest prices, 72-hour delivery. Big commissions advanced. Amazing bonus. Cuts furnished for every business. Experience unnecessary. Outfit free. Northwestern, 2002 Division, Chicago.

SALESMEN—Don't miss this one: sell "Suredge," the only low-priced guaranteed automatic razor blade sharpener, honing and stropping all blades in ten seconds. 100% commission. Wonderful demonstrator. Real fast seller. Suredge, 15 East 40th St., Dept. G, New York.

\$2.95 AUTO Seat covers; pay daily; sales outfit free. Standard, 1933 Godfrey, Philadelphia.

KLEEN-FOOT Balm cleans the feet of minor troubles everyone has. Free trial. If it cures, sell! 807 Mather Bldg., Washington, D. C.

PUNCHBOARD Salesmen. \$10,000 yearly. New line. All fast sellers. Lowest prices. Full commission on repeat business. Catalog free. Hurry! Puritan Novelty Co., 1409 Jackson, Chicago.

AMAZING Screw-holding screw driver! Factories, garages, workers buy on sight! Profit 75c each. Exclusive territory. Free trial offer. Jiffy, 1273 Winthrop Bldg., Boston.

PUNCHBOARD Salesman. New deal. \$25 daily profit. Great assortment. No selling. Repeats. Free outfit. Manager, 4330 G. Harrison, Chicago.

BUSINESS Stationery—Largest line, commission paid daily. Sells all merchants. Pocket outfit free. Willens Co., Dept. 209, 9130 Gladys Ave., Chicago.

SEVERAL, Active, honest, clean-cut salesmen wanted at once. Well known Detroit manufacturer of the nationally known Stover's Athletic Oil, used and endorsed by Howard Ehinke, world series hero; Sammy Mandell, world's lightweight champ, and most all other major league athletes and champs, has special and alluring proposition to make to men selling on retail trade. Your territory may be open. Write today. Stovers, Inc., 7523 Fenkell, Detroit.

PUNCHBOARD Salesman—Most gigantic line ever featured. Vending machines, all kinds. Make high as \$28.00 on single order. Repeat commissions. Beautiful colored catalog free. Lion Mfg., Dept. 8, 368 W. Erie, Chicago.

\$18 TO \$25 Daily; biggest selling line of 2-piece suits, \$9.95 and \$12.50; 3-piece wool suit, \$17.95 (regular \$28.00 value). All-wool overcoats \$18.50. Splendid raincoats, slickers and boys' suits. Biggest commission. Free outfits. "Jim" Foster, Inc., Dept. 212, 2250 S. Spaulding Ave., Chicago, Ill.

WHILE Others talk, our salesmen actually clean up. \$9.50 commission on ten-minute sale at \$18.50. Original Electric Hot Dog Machine. Write for available territory. Leonard E. Dickerson, Manufacturer, Dept. E-19, Springfield, Mo.

FREE Booklet describes 67 plans for making \$20-\$100 weekly in home or office business of your own. Elite Co., 34 Elizabeth St., New York.

BECOME Your home town leading business man. Sell full line of groceries, motor oils, paints. Everybody a customer. No capital or experience necessary. Selling outfit free. Write Laverin & Browne, 1602M So. State, Chicago.

FURNACE Carburetor for any heating furnace or boiler. Eliminate 80 per cent of smoke and soot. Reduces coal bill one fourth. Easily installed and operated. We offer you a permanent business with a big profit. Give sales experience, reference and territory covered, when answering. National Engineering Company, Lancaster, Pa.

PUNCHBOARD Salesman—\$200 weekly. New deal. Biggest commissions. Repents, liberal cash bonus besides. New catalog. Write Superfine Sales REP-531 So. Franklin, Chicago.

ZINGOIL. The new petroleum oil hand-cleanser, outsells two to one any other cleaner on the market; replacing ordinary hand soaps wherever shown; if you can't build up a business worth \$100 weekly with Zingoil, quit calling yourself a salesman. B. C. Carter Co., 6647 Foothill Blvd., Oakland, Calif.

BRUSH Salesmen attention! We pay highest commission, furnish your gift brushes free, give larger (restricted) territory, promote you quickly. Prices reasonable, quality line more complete, nationally known, tested, approved Good Housekeeping. Act now, company expanding. Donald Brush Co., Camden, N. J.

SPARE Time work for young men selling the super automatic oil heater (for residences) to the trade. Generous commissions on all wholesale sales. Write the Super Oil Heater Sales Company, 275 Connecticut Boulevard, Hartford, Conn.

COVERALL Salesmen—Make \$20 daily selling new \$3.50 improved coveralls, also service coats with customers name embroidered on back. Unusual construction. Commission 75%! Wonderful advertising value. Lowest price; highest commission. Free outfit. Am. B. Co., AS-418 S. Wells, Chicago.

AMAZING Auto oil garage whet. Sell garages by the gross as well as car owners. Particulars with sample 10c. refunded. George Koch Sons, 2112 Pennsylvania St., Evansville, Ind.

BURGLAR Locks—For residence windows and doors. Locks then closed or partly open for ventilation. District sales manager of salesmen for each city. 40% commission should run \$1,000 to \$18,000 per year. Turney Mfg. Co., Sales Dept., Melroe St., Kansas City, Mo.

\$1.500 POLICY For \$1.00 a year. Big profits. Easiest, fastest selling proposition ever offered. United States Registry, Desk 10, Townsend and Superior Sts., Chicago.

SALESMEN, Dealers, service men investigate this new radio device. First time advertised. Doubles volume and distance. Can demonstrate coast to coast in summer. Brings in stations never heard on set before. Territories to producers. Write W. H. Laferty, Sales Mgr. 279 Brighton Ave., Detroit, Mich.

SELL Goodwear raincoats; \$2.95 up. Good-year Rainwear, 682 Sixth Ave., New York.

PUNCHBOARDS—Hottest, largest money-making line ever offered. Season starting. Best commissions. Nothing to carry. Catalog free. Acil M&L Sales, 301 W. Adams, Chicago.

WONDERFUL Invention. Seals fifty envelopes minute. Sells on sight at \$2.25. Attractive trial offer. Square deal. Bank references. Kendall Sealer Co., 440 Sansome St., San Francisco, Dept. 14.

\$250 TO \$100 Monthly for salesmen. Our goods sell quickly to factories, hotels, garages, public institutions, etc. Large profits. Year around repeat business. Exclusive territory. Free samples. Vasco Products, Elmira, N. Y.

\$50,000 PICTURE Man Friedman made canvassing. Beginners can make \$100.00 weekly with my sales talk. Experienced men make more. Free book "Profits in Portraits" explains. Sample free. Picture Man Friedman, Dept. 8, 100 West Austin, Chicago.

ELECTRICAL Tool line selling to garages, mechanics and auto owners. Wonderful demonstrators, big commissions. Salesmen, write Barker Specialties, Girard, Penna.

SALESMEN—America's leading collection service wants you to help doctors, merchants collect their bad accounts. You list them; we collect. Hustlers actually make \$75-\$100 weekly. Pleasant work, increasing profits. Get the facts. Arrow Service, 39 Jay St., Schenectady, N. Y.

SALESMEN—Become independent. Own your business; experience unnecessary. Selling our \$10,000 Accidental Death; \$50 Accident; \$25 Stick Weekly Benefits—\$10.00 yearly. Other amounts proportionate. Guaranteed steady income from renewals. \$250,000 deposited Insurance Department, Universal Policy Dept. A, 40 Clinton St., Newark, N. J.

MAIN Or sideline. Sell auto tires and auto accessories to tire stores, garages, etc. Protected territory. Liberal commission. Economy Rubber Products Co., 604 Burkhardt Ave., Dayton, Ohio.

NEW Invention—Sell every business. Four \$15 sales daily pay \$288 weekly. Walker made \$165 first day. Exclusive territory. Adjustment Service, Dept. PM, Mobile, Ala.

WANTED District managers—Capable men to represent us in prosperous territories with direct home office contact. Our organization is the oldest of its kind in the health and accident business and offer exceptionally remunerative compensation. Write today for information. Dept. 18, Inter-State Business Men's Accident Association, Brown Bldg., Des Moines, Iowa.

GOLD-LEAF Window letters and script signs; no experience; 500% profit; samples free. Consolidated, 69-V West Van Buren, Chicago.

SALESMEN—Four \$15.00 sales to merchants net you \$40.00 daily. Sapers Systems, 2813 Sheffield, Chicago, Ill.

TO Market 1A garage door holders, simple automatic action, quickly installed, instantly attracts garage owners, builders, dealers. Write for exclusive territory proposition. Knowlton-Stevenson Co., 1118 Packard, Ann Arbor, Mich.

PUNCHBOARD Salesmen make \$200.00 weekly selling punchboards and vending machines. Big repeat commissions. Beautiful 3-color catalog free. Best season now. Write today. Old reliable company, established 20 years. Lincoln Sales, 116 S. Wells, Chicago, Dept. D.

\$60-\$200 A WEEK. Genuine gold letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-A North Clark, Chicago.

HELP WANTED

NO Dull times selling food. People must eat. Federal distributors make big money; many over \$3,000 yearly. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license, sample case and free samples for customers. Repeat orders sure; exclusive territory. Ask now! Federal Pure Food Co., C2367 Archer, Chicago.

YOU Are wanted to resilver mirrors at home. Immense profits plating autopaarts, tableware, etc. Write Sprinkle, Plater, 287, Marian, Ind.

IF You need \$100, \$500 or \$1,000 to pay your bills, buy new clothes, furniture, etc., I'll show you a new, easy way to make it as my local representative. No experience or capital required. Albert Mills, 3948 Monmouth, Cincinnati, Ohio.

OBTAIN Employment desired, quickly, anywhere. Learn how. Write Box 39-203, Station K, New York.

MANUFACTURER Wants distributor for 300-mile \$2.00 "Pocket" radio. "Sells itself with music." Pays 100%. Spencer Radio, Dept. 10, Akron, Ohio.

CASH Paid for Butterflies, Insects. See Similar Display Advertisement on page 24.

BOYS, Girls, make some extra spending money during your spare time. No experience necessary. Albert E. Pickett & Co., 3019 Diversey Ave., Chicago, Ill.

BIG Wages in Canada, construction work, all trades! Write for list of positions, stamp appreciated. A. Allard, 4724 Des Erables, Montreal, Can.

EDUCATIONAL AND INSTRUCTION

LEARN To figure twice as fast by studying Smith's "Higher Arithmetic" at home. Write for prospectus to P. A. Smith, 609 S. Dearborn St., Chicago.

MAKE Money—Raise canaries for us year round, we buy all. Free: Outfit, birds course. Send 10c for particulars. Schneisler's Canary & Pet Plant, Dept. 21, 5 East North, Buffalo, N. Y.

GOVERNMENT Jobs. Become railway postal clerks. \$1,900 to \$2,700. City carriers, postoffice clerks. (\$1,700 to \$2,300). General clerks, file clerks (\$1,250 to \$2,500). Men-women, 18 up. Steady work. Life positions. Paid vacation. Common education sufficient. 25 coached free. Particulars free. Write today sure. Franklin Institute, Dept. D3, Rochester, N. Y.

COMMERCIAL Art pays good, new \$1.00 lesson plan leads to success. Write. Integral School of Commercial Art, Melrose Park, Ill.

MEN 18-35. Railway postal clerks, \$178.00-\$225.00 month. Steady. Examinations coming. Common education sufficient. Particulars free. Write immediately. Franklin Institute, Dept. D14, Rochester, N. Y.

FIREMEN, brakemen, baggage men (white or colored), sleeping car, train porters (colored), \$150-\$250 monthly. Experience unnecessary. \$10 Railway Bureau, East St. Louis, Ill.

STUDY A scientific profession. Microbiology. Bacteriology. Sanitation. Extension-residential course. Diplomas, degrees granted. Urinalysis outfit-prospectus free. College of Microbiology, 23 State, Hammond, Ind.

AMATEUR Cartoonists: Sell your cartoons. New market. Smith's Service, PR-1194, Wenatchee, Wash.

PRIVATE School for boys and girls. Wilson Schools, Dayton, Ohio.

DOUBLE Entry bookkeeping 60 hours with 8 keys; guaranteed. (Diplomas.) International Bookkeeping Inst., 8 Springfield, Mo.

DON'T Prepare for any civil service examination without seeing our catalog. Free. Columbian Correspondence College, Washington, D. C.

BIG Demand for photoplay talking picture and magazine stories. We revise, develop and copyright. Sell on commission. Established 1917. Booklet free. Universal Scenario Company, 406 Western and Santa Monica Bldg., Hollywood, Calif.

LEARN Aircraft welding, auto mechanics, electricity. Magneto, radio. Big pay. Big demand. Low rates. Free catalog. Stevenson School, 2008A Main, Kansas City, Mo.

WANTED Immediately, men-women, 18-35, qualify for permanent government positions. \$105-\$250 monthly; no gov't experience required; paid vacations; common education; many needed soon. Write Ozment Inst., 101, St. Louis, Mo.

BECOME A landscape architect. Uncrowded profession; wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Est. 1916. Write for details. American Landscape School, 29 Plymouth Bldg., Des Moines, Iowa.

U. S. GOVERNMENT Wants men, \$1,700-\$1,900 and up at start. Railway mail clerk examination coming. Let our expert (former government examiner) prepare you for this and also rural carrier, post office, customs, internal revenue, and other branches. Write today for free booklet, Dept. S, Patterson School, Rochester, N. Y.

VALUABLE Kinks for Machinists. 419 time-saving ideas on various phases of machine shop work. Intensely practical. 287 illustrations. Just write for "Machinists' Kinks" and pay postman \$1.50 plus postage when he delivers the book. Popular Mechanics Press, Room 508, 200 E. Ontario St., Chicago.

TYPEWRITERS AND SUPPLIES

SIMPLEX Typewriters \$3-\$8; Remingtons \$12.00; catalog 5c. Deemo, 114 Ford St., Peabodine, R. I.

TYPEWRITERS—Factory rebuilt Royals, Remingtons, Underwoods. New Royal, Remington and Corona portables. New "Excelligraph" Rotary Stencil Duplicator \$37.50. Catalog free. Pittsburgh Typewriter Supply, Dept. 045, Pittsburgh, Penna.

TYPEWRITERS, All standard makes. \$10 up. Fully guaranteed. Free trial. Write for complete illustrated lists. Northwestern Typewriter Exchange, 121 N. Francisco Ave., Chicago.

TYPEWRITERS—All makes, fully guaranteed. \$15.00 and up. Write for catalog. M. & M. Typewriter Co., 180 W. Washington St., Chicago.

TYPEWRITERS, Radios, motorcycles. \$4.98-\$24.98. Knights, 1524 Locust, St. Louis, Mo.

TYPEWRITERS—All makes. \$6 to \$29. Fully guaranteed. Dea Typewriter Exchange, Ada, Okla.

ADDING MACHINES

NEW \$3.50 Automatic adding machine. Adds, subtracts, multiplies, absolutely accurate. Capacity \$999,999.99. Fully guaranteed. 75,000 pleased users. Makes adding easy, positive, quick. Eliminates mistakes. Saves time. Postpaid \$3.50. Bassett Co., 1458-D, Hollywood Ave., Chicago.

PRINTING, ENGRAVING AND MULTIGRAPHING

BIG Free printing line brings easy quick profits. Union label. Bigger commissions—up to 55%! Experience unnecessary. Now write orders with America's most profitable printing stationery line. Thousands of free cuts. Over 150 standard items covering every business need: letterheads, noteheds, envelopes, billheads, business cards, statements, garage forms—shipping, battery, dry cleaning, tire, storage, parking and lat-cleaning tags; repair forms; blotters, gummed shipping, drug, advertising stickers, etc. Lowest prices. Steady repeat orders. Ship everywhere. New free outfit just off press. Write quick. Dept. 178, Box 498, Cincinnati, Ohio.

PRINTING—Low prices, fine work. New price list and samples. Stationery, circulars, folders, booklets, catalogs, ruled forms. Sell direct, large or small orders. Large modern plant in small town, low operating cost. Shenandoah Publishing House, Inc., Box 1140, Strasburg, Virginia.

WE Print stationery, booklets, catalogs, circulars. Samples. Commercial Press, Batavia, Ohio.

200 LETTERHEADS And 100 envelopes \$1.00. 200 letterheads, 8 1/2 x 11, 150 envelopes \$2.00. 250 cards \$1.00. Hoosier Print Shop, Portland, Ind.

PRINTED Stationery for personal or business use. 200 note heads and 100 envelopes only \$1.75 postpaid. Satisfaction or money refunded. Redfield Co., 515 Sedgwick Drive, Syracuse, N. Y.

PRUITT Pays postage on all printing orders. Satisfied customers in every state. Free samples. Pruitt, Brookfield, Ill.

5,000 3 1/2 x 6 TINTED Enamel folders, \$13.75; 5,000 elegant envelope slips, \$3.00. All printing low prices. Samples. Goodprint, Harrisonburg, Va.

STATIONERY—1,000, \$2.75; 5,000, \$10. Samples. Vincent Mosher, 323 New, Newark, N. J.

1,000 BUSINESS Cards \$2.75 postpaid. Samples free. John Miller, Montgomery Ave., Narberth, Pa.

500 BUSINESS Cards \$1.10, 500 letterheads, envelopes \$1.95. 2,000 6 x 9 circulars \$3.50 postpaid. Wm. Sirdevan, Ravenna, Ohio.

500 BUSINESS Cards, \$1.25 postpaid. Other printing reasonable. Attractive samples free. Hanzer's, 1039 S. Cleveland, Phila., Pa.

200 NOTE Sheets and 100 envelopes \$1. Brown, Warsaw, N. C.

PARTICULAR? "Neargature"—Special 500 8 1/2 x 11 letterheads, 250 envelopes, \$4.44 postpaid. Samples. Sellidays, Knox, Ind.

QUALITY Printing on quality paper. Prices and samples. Burket Printing Company, Roaring Spring, Pa.

SPECIAL High grade business statements \$1.95 thousand. Many bargains. Battifield Press, Gettysburg, Penna. Free battifield souvenir.

1,000 6 1/2 ENVELOPES Printed \$1.35. Free samples. Spors Printery, Lesueur Center, Minn.

500 HAMMERMILL Letterheads or envelopes \$2.00. Patton Company, 534 Paxton, Block, Omaha, Neb.

200 8 1/2 x 11 HAMMERMILL Bond letterheads, envelopes or business cards \$1.00 postpaid. Race Printing Company, Hudson, N. Y.

CIRCULARS, 5,000—5 1/2 x 8 1/2—\$11; 3 1/2 x 6—4-Page folders \$14. Big plant. Little prices. Garrison Press, Harrisonburg, Va.

1,000 HAMMERMILL Letterheads or envelopes \$3.25. Cards, statements, billheads, 5 1/2 x 8 1/2 letterheads, \$2.50 cash delivered. The B. & M. Press, "Printers Extraordinary," Dawson, Okla.

MULTIGRAPHING—High grade business letters. Two dollars fifty cents thousand. Commercial Printing Company, 7054 N. Clark St., Chicago.

SAMPLES Raised letter printing with special prices free. LaCisde Service, Westfield, Mass.

\$2.00 1,000, LETTERHEADS, Noteheds, envelopes, cards, billheads, tags, postcards. Samples free. Coyle & Khaballs, Newport, N. Y.

MULTIGRAPHING Business correspondence two dollars thousand. Hammermill letterheads, four dollars; inexpensive quality, three dollars. Miscellaneous printing. Mayera Corporation, Monmouth, Ill.

QUALITY Printing! Reasonable Prices! Send for Free Standardized samples and prices. Folders, Circulars. Catalogs our specialty. Earnest Fantus, 525 South Dearborn, Chicago.

250 BOND Letterheads, Envelopes, Billheads, Cards, \$1.35 each. Economic Press, Leonia, N. J.

GOOD Printing, reasonable prices, distinctive ideas. Stationery, circulars, blotters. Samples free. J. Wilford Price, Hartleysville, Pa.

PRINTING OUTFITS AND SUPPLIES

PRINT Your own cards, stationery, circulars, advertising, etc. Junior press \$5.90; job presses, \$11; rotary, \$149. Print for others; big profit. Easy rules furnished. Write for catalog presses, type, paper, etc. Kelsey Company, Q-11, Meriden, Conn.

PRINTING Outfits—Presses, type supplies, type novelties. Send stamp for catalog. Model Press, York, Penna.

MAKE Your own printing device. It's practical—different! Particulars, specimens free. Grinstead Laboratories, Oswego, Kans.

PREUSED Printing presses and supplies. Lists 2c stamp. Popular Bargains, Richland, Pa.

GUMMED LABELS

1,000 PRINTED: Name, business, address 50c. JBS Company, Box 93, Holyoke, Mass.

RUBBER STAMPS

RUBBER Stamps! Name, address, two lines 25c; three lines 35c. DeLux Stamp Works, B572M, Auburn, Nebr.

DUPLICATORS AND DEVICES

YOU Can make 50 to 100 copies of a letter, notice, etc., at a cost of three cents on a Hoyer Quality Duplicator. Write for free trial offer. The Hoyer Duplicator Co., 303 Jackson Blvd., Chicago, Ill.

"EXCELLIGRAPH" Portable rotary stencil printing duplicators \$39. Terms. Description, testimonials, printed samples, free. Pittsburgh Typewriter Supply Co., Dept. 531, Pittsburgh, Pa.

FOR THE HOME

HEAT Regulator. Make one for your own furnace. Simple, effective. No batteries. Handy man can make for few dollars. Send \$1.00 for blue prints. Gryce System, 2416 E. 43rd St., Minneapolis, Minn.

EGG-TIMER With bell; makes soft, medium, hard-boiled eggs certain. \$1. Lelipe, P. O. Box 388, San Francisco.

CEDAR Chests only \$11.65—"Red-i-Kut" complete with rich copper trim—you assemble and save half—send for pictures. Kuempel Furniture Company, Guttenberg, Iowa.

SEWING Machine stock. New and used. Lowest prices on parts and accessories. Paul Steckel, Glendora, Calif.

FOR MECHANICS

ATTENTION—Home mechanics: We sell unusual cabinet hardware, chest trimmings, tea wagon wheels and casters, big line small hinges, locks, etc. Upholstering supplies electrical hardware, knicked down cedar chests, etc. Send ten cents stamps for catalog. Thurston Manual Training Supply Company, Jobbers and Manufacturers, Anoka, Minn.

A BIG Opportunity in 8-hour battery charging or 20 minute car washing. Let me tell you how you can install equipment with practically no investment. Earn \$150 to \$300 monthly. Bargains in used oil. Also a few reconditioned buffers, grinders, air compressors, paint sprays, are welders. Write today. Ken Byron, Box M-1295, Troy, Ohio.

FOR SMOKERS

SMOKE Tampa cigars. \$4.50 a hundred, prepaid. Hand made. Ideal Xmas gift. Try them once, smoke them always. Cunningham, Box 374, Tampa, Fla.

AUTOMATIC Cigarette making machines. Rolls, glues 50 for 10 cents; illustrated folder. Postpaid \$2.50. For home use, Automatic Cigarette Machine Works, 6247-51 Broadway, Chicago.

RAZORS AND BLADES

NEW Automatic safety blade sharpener selling like wildfire. Makes old blades better than new. Improves new blades 100%. Prolongs the life of any blade indefinitely. Quickly pays for itself. Every shaver wants one. Sharpens all blades including Gillette, Durham Duplex, curved blades, etc. Simple, compact, easily operated, guaranteed. Agents get free goods bonus proposition. Sample post paid \$1.00, all countries. Viking Blade Company, 1706 Sunset, Los Angeles, Calif.

SHARPEN Razor blades. Build a business for yourself. Make a dollar per hour with our machines. Easy, light work. Ideal proposition for elderly men. Fully equipped machines \$175.00. Velvet Edger Mfg. Co., 725 West 30th Place, Los Angeles, Calif.

NEW Gillette type razor blades. 30 for \$1.00. Every blade guaranteed. Superior Blade Co., Box 1516 Cincinnati, Ohio.

30 GILLETTE Style razor blades, 1 dollar prepaid. World's best. Genuine Swedish steel. Handelskomp, Rellance, Landskrona, Sweden.

GILLETTE Razor blades resharpened 100% keen, 1c each. Petter Wetterquist, Rockford, Ill.

RAZOR Blades sharpened; two-edge blades 3c, single blades 2c. J. Newman, 6402 Ellis Ave., Chicago, Ill.

GUNS, FISHING TACKLE AND SPORTING GOODS

SHOTGUNS: Single barrel \$9.00; double, hammerless, \$21.75. American manufacture; money-back guarantee. Free catalog. Franklin Sporting Goods, Box 10, Ampere, N. J.

HUNTERS And trappers: See and try the "Screw-Dog," a mechanical ferret for routing rabbits, skunk and other burrowing animals. Sold by mail, allowing five days' trial with an absolute money-back guarantee. Price \$4.00 each, with order prepaid, or C. O. D. plus postage. Free circulars and testimonials. The Grabow Co., Dept. A, Franklin Square, L. I., New York.

FIELD GLASSES

USED Fieldglasses: \$2 to \$75. J. Alden Loring, Dept. J. O-we-go, N. Y.

ARCHERY

MAKE Your own archery equipment. We furnish complete line highest grade materials and complete instructions for assembly. Can easily build highest quality outfit for fourth cost of complete outfit. Letter brings complete catalog and prices. Sidney Archery Co., Box M119, Sidney, Ohio.

CIRCULAR Free—Yew bows and bow-staves. Arrows—Highest quality, tackle, reasonable prices. Harry Hobson, Lyons, Ore.

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GERMAN Iron cross \$1.00; Bohemian medal of honor. 80c. List of medals 10c. Dare, 670 E. 42d, Brooklyn, N. Y.

ANTIQUES, Firearms, swords, relics, daggers, curios. Catalog free. Nagy, 8 South 18th, Philadelphia.

FINANCIAL War relics. Collectors find rich material for den or office in our free list. Prentiss, 1629 Meyer Court, Chicago.

FOR Sale, mounted heads, birds, antiques. Lee Henderson, Stanley, Wis.

SEND 5c For fine new list Indian relics, antique firearms. F. E. Ellis, Webster Groves, Mo.

INDIAN Stone relics. 32-page catalog 5c. Gruenzacher, Mukwonago, Wis.

MINERALS, PRECIOUS AND SEMI-PRECIOUS STONES

TOPAZ, Finest quality, colorless or smoky. The birthstone for November. Buy your stones direct and save money. Some stones low as \$10.00. Can supply any size wanted up to twenty carat. R. A. Garner, Box 188, Lancaster, Pa.

AGATE Jewelry, polished stones. Cabinet specimens. Opals, zircons others. Indian arrow points. Cutting mounting. E. W. Birch, The Stone Man, Box 34, Salem, Ore.

WE Are dealers in rough and polished minerals and polished semi-precious gems for scientific, educational, cabinet display or jewelry craft purposes. List of gem minerals and their varieties, table of birthstones and price lists free with an order for any of the following. **PM Special**—Six assorted rough and polished minerals for \$1. Four genuine mined, fully polished gem stones \$1. Two interesting Montana mineral specimens 35c. Any of these postpaid, correctly labeled and with satisfaction guaranteed. The Gem Shop, Box 373, Wolf Creek, Mont.

BOATS AND LAUNCHES

BUILD Your own boat. Commence building now and be ready for next season. Use our ready cut semi assembled materials. 55 designs outboard speedsters, runabouts, cruisers, sail, etc. Send 10c for catalog. Brooks Boat Co., Box S. S., Saginaw West Side, Mich.

MAKE Rowboats, houseboats, canoes. Interesting literature free. Weesha-Uco, 31st Office, Detroit, Mich.

16' CANVAS Canoe. Easily made. Blueprint 30c. Weesha-Uco, 31st Office, Detroit, Mich.

TWENTY Mile outboard racer. Complete plans 25 cents. Free boatbuilding catalog. The Rudder, 15 Murray St., New York.

MAKE 16' Rowboat. Blueprint 30c. Weesha-Uco, 31st Office, Detroit, Mich.

PHONOGRAPHS AND RECORDS

REPRODUCES Voice. Make your own phonograph singing, talking records. \$25. A. Lelap, Box 388, San Francisco.

BUILD Your own phonograph. Parts catalog with instruction mailed for 10c. American Phonograph Co., 3602 Wesley, Berwyn, Ill.

MUSIC AND MUSICAL INSTRUMENTS

COMPOSERS—Verse or music. Brilliant opportunity. Write Van Buren, 1906 McClurg Bldg., Chicago.

EASY To be a drummer. We show you how. Complete trap drum outfit \$40 and up. Easy payments. Free trial. Ludwig, 1611 North Lincoln St., Chicago, Ill.

SONG Poems arranged for publication. Submit poems for examination. Brennan, 11632 1/2 W. Way, New York.

SONG-POETS—"Your Best Bet." Healy, Liberty Theater, Colorado Springs, Colo.

\$15.00 UP For a musical instrument. Catalog and complete details on request. Mention what instrument you are interested in. Carl Fischer, Inc., 58 Cooper Square, New York.

SONGWRITERS: Substantial advance royalties are paid on publisher's acceptance. New booklet, "Song Requirements of Talking Pictures," sent free. Newcomer Associates, 790 Earl Bldg., New York.

HOW To market your song. Send for free information. Song Writers Press, 3647 Bloomington Ave., Minneapolis, Minn.

SONG Poem writers. "Real" proposition. Hibbeler, D1, 2104 N. Keystone, Chicago.

VIOLINS—Hand-made masterpieces. John Lehto, 513 14th San Pedro, Calif.

POEMS Wanted. Work guaranteed. We publish. Great Eastern Song Bureau, Dept. 27, Thomaston, Me.

SEND Song poems, 50-50 plan. Indiana Song Bureau, (Brookside), Salem, Ind.

SONG Poem writers. Write Sequoia Songwriters Service, Sherman Branch, Los Angeles, Calif.

VIOLINS, Deep, mellow, soulful—on credit. Easy terms for wonderful instrument. Get details today. Gustav F. Henning, 302 University Building, Seattle, Wash.

CORNETISTS—Trumpetists—Saxophonists—Clarinetists. Get "Free Pointers." Name instrument. Virtuosi School, Buffalo, N. Y.

PLAY Plans by ear. A sound system. Booklet free. Boucher's Harmony Studio, Ottawa, Can.

"MUSIC Composed" to words. Bauer Bros. (formerly of Sousa's Band), Oshkosh, Wis.

SONG Writers. Send for our "Publishing Agreement." McKinley Music Printers, 1501 E. 53rd St., Chicago.

WRITE Songs. Big money and reputation. Write for information. J. Gordon Pub. Co., 301 N. Hoyne Ave., Chicago.

SONG Poems solicited. A different proposition. Richard Broughton, Sioux Falls, S. Dak.

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INVENTIONS Patented; confidential advice; inventions developed—representative for Blais Tool and Machine Corp.; trademarks registered. Edward Gottlieb, Patent Attorney, 5 Beekman St., New York.

JOHN PATTEN DUFFIE, Registered patent attorney, Victor Bldg., Washington, D. C. Reasonable rates. Advice free. Booklet. Prompt personal service.

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SCRAPER, 3,728,036; Sept. 10, 1929. Trolley, 1,729,924, Oct. 1, 1929. John Rozowich, 1404 Eddy St., San Francisco, Calif.

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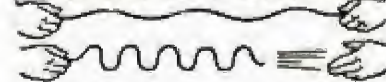
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For advertising purposes a sample of this revolutionary new weatherstrip is being sent to interested people. With it are included the many astonishing details that there is naturally not room to print in this limited space. Get the facts along with our low-cost introductory offer. Mail the coupon at once.

FREE SAMPLE!

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Name
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[] Put check mark here if you want to make money as our agent.

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Learn the secret of my success. Use my money-making system. Get into the biggest business of all—where the most money is. Start right at home, in your spare time. Mail coupon and learn how.

ONE hundred thousand dollars—a comfortable fortune. That's the net profit I made in less than five years in the biggest and best business in the world.

And the hard-to-believe part of it is that I started right at home, in my spare time, with less than \$5 capital and no experience in the business.

Of course, I don't expect you to take my word for this. You don't know me. So I don't blame you for saying, "I'm from Missouri."

But I do expect you—for your own satisfaction—for your own profit—to sign and mail the coupon and receive—without a penny of cost or the slightest obligation—the most convincing proof of the greatest opportunity for business success you ever saw—proof of my own success—proof of the success of hundreds of ambitious men and women—from 21 to 65—who are using my amazingly successful business system—proof of how you—yourself—can use my method of money-making to build up a permanent, profitable business of your own—right at home, in your spare time.

The Best Business

When I say that my kind of a business is the biggest and best business there is, I have at least ten reasons for saying so. Here they are:

1. The business in round figures amounts to about 28 billion dollars yearly.
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4. It is the most permanent of all businesses. It cannot be injured by changes in fashion or by any human whims or caprices.
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6. It is a pleasant, healthful, high-class vocation.
7. It does not take years of study to learn like most businesses or professions.
8. It is a business suited to young and old of both sexes.
9. You do not have to keep a stock of goods, invest in machinery, or buy any expensive tools or instruments to get started.
10. You can start in your spare time, right at home, with a few dollars capital, just as I did.



You can't afford to turn your back on this remarkable business opportunity

I know of no other business, of any kind, anywhere, that includes all of these important advantages. That is why I say it is the biggest and best business there is. That is why you should investigate this business at once. That is why you should mail the coupon now and learn about the big, quick money that is being made in this immense and profitable field.

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Enthusiastic letters pour in from those who are making money with my successful system. Read these words of praise:

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There's no room here for more such letters, but sign and mail the coupon and you will receive a bunch of the most enthusiastic letters of business success you ever read.

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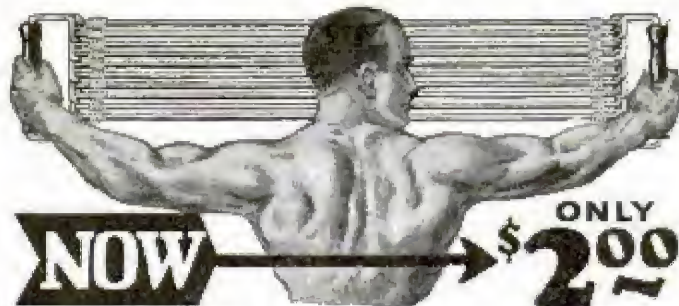
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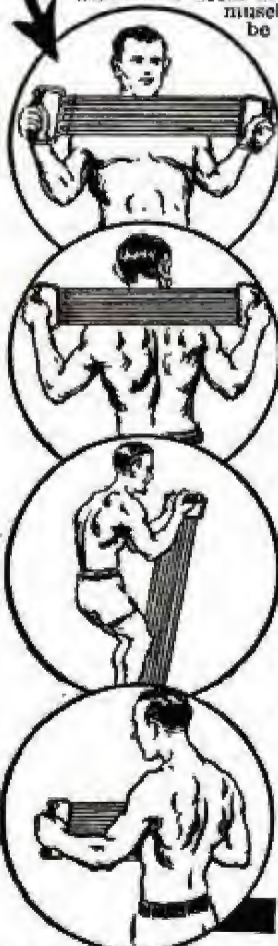
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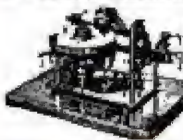
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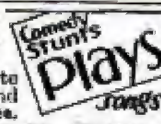
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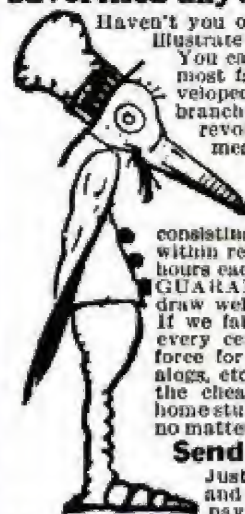
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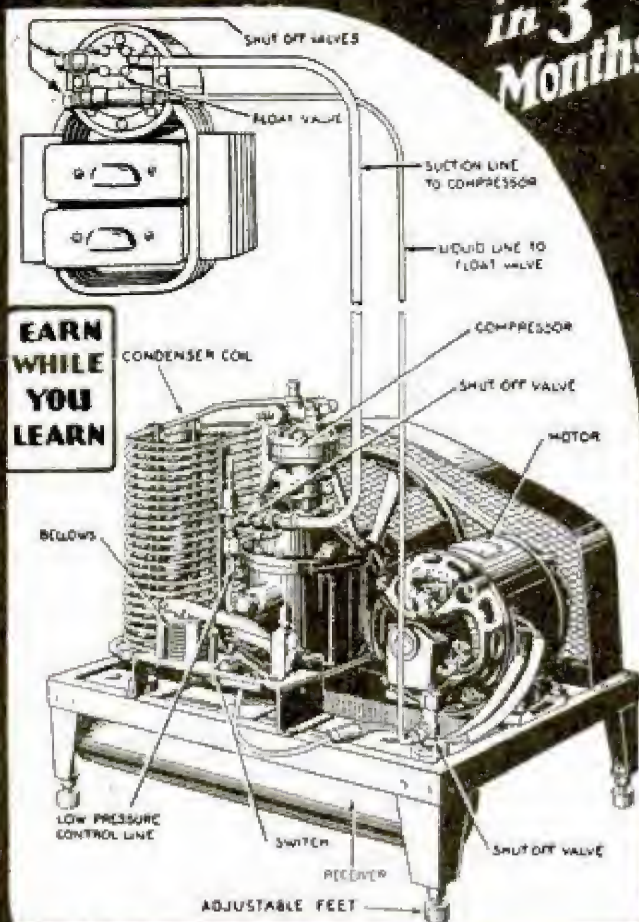
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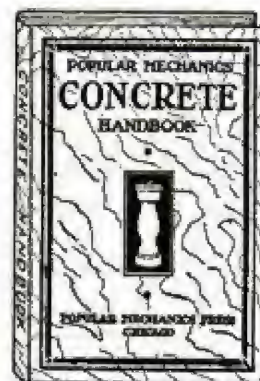
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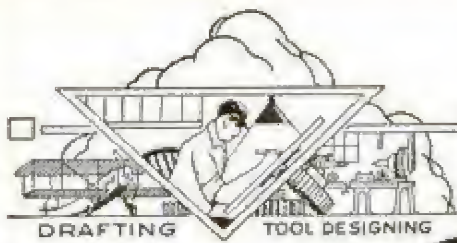
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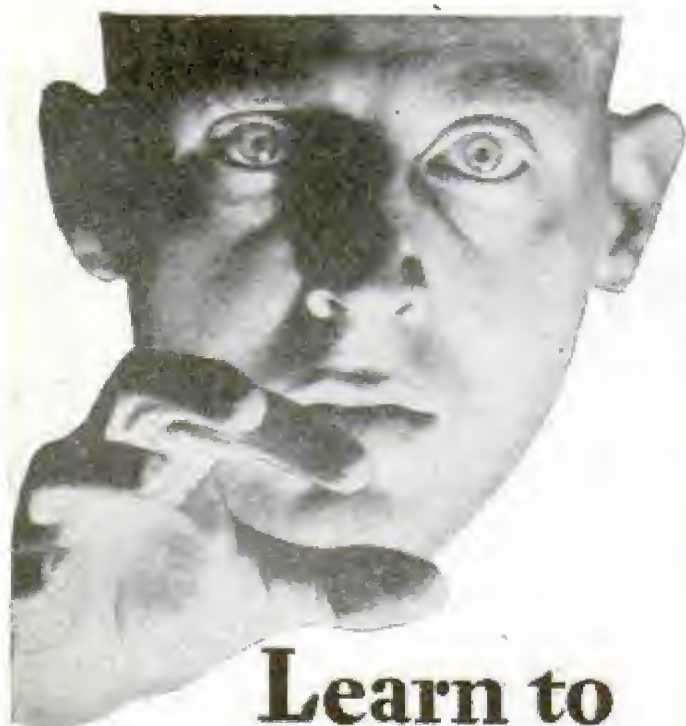
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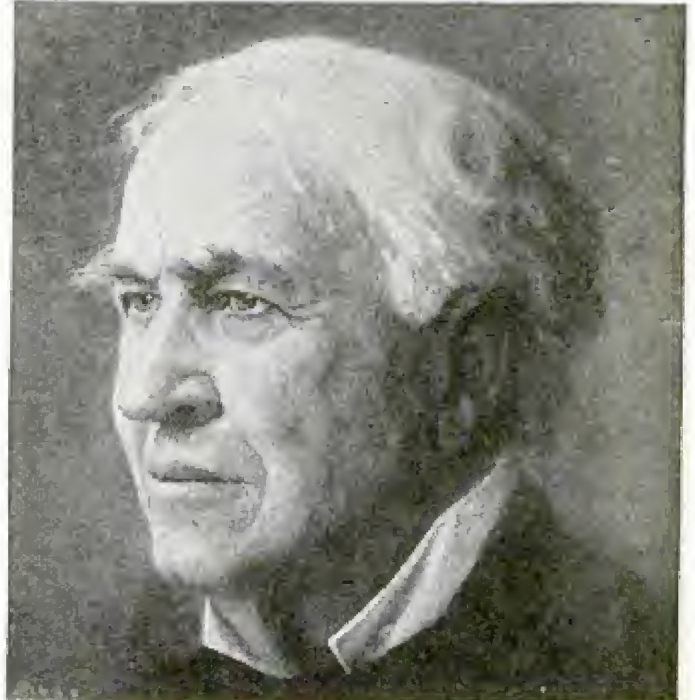
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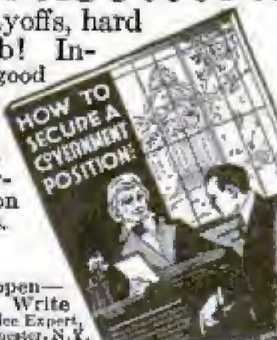
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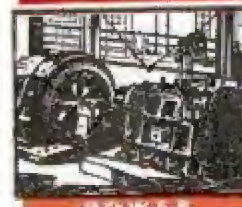
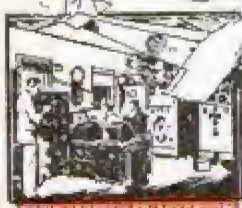
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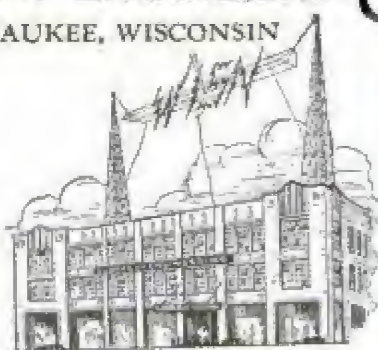
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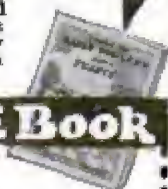
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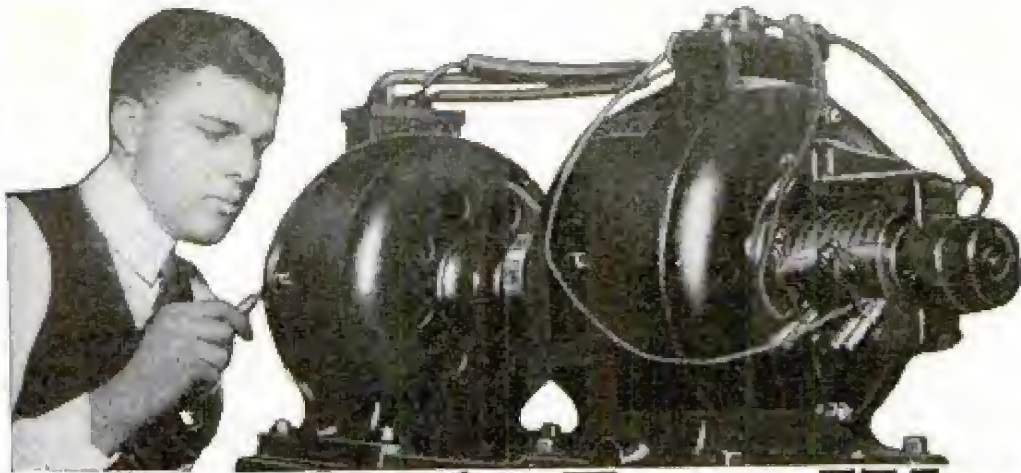


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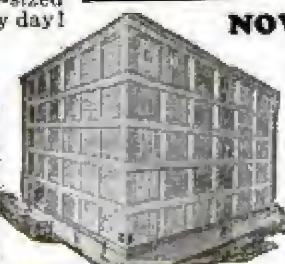
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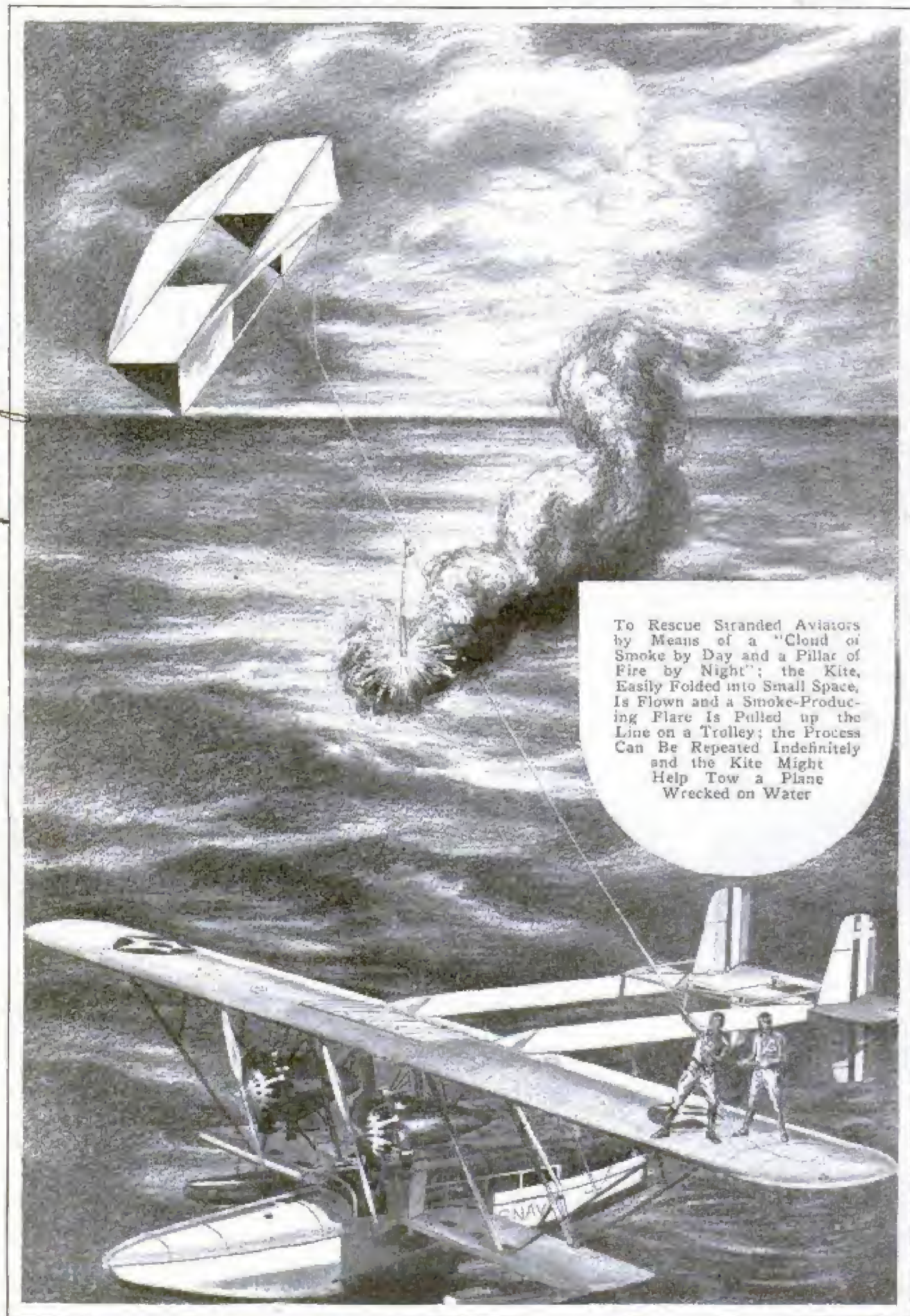
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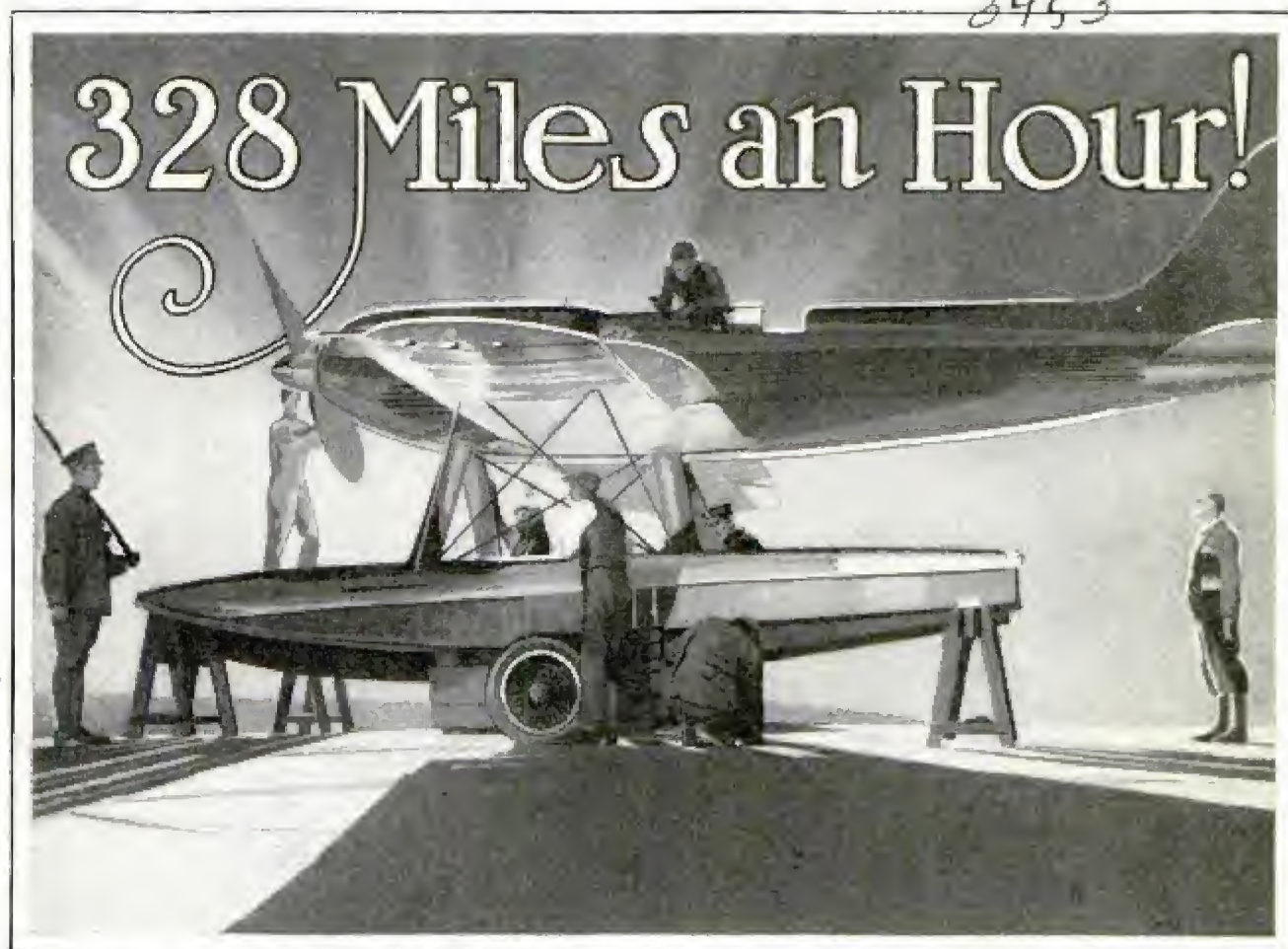
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WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 52

DECEMBER, 1929

No. 6



News Was Received at Night That Italy Had Not Withdrawn from the Schneider Cup Races. So Work Proceeded on the Second Supermarine Rolls-Royce at Calshot with the Aid of Searchlights

PA.

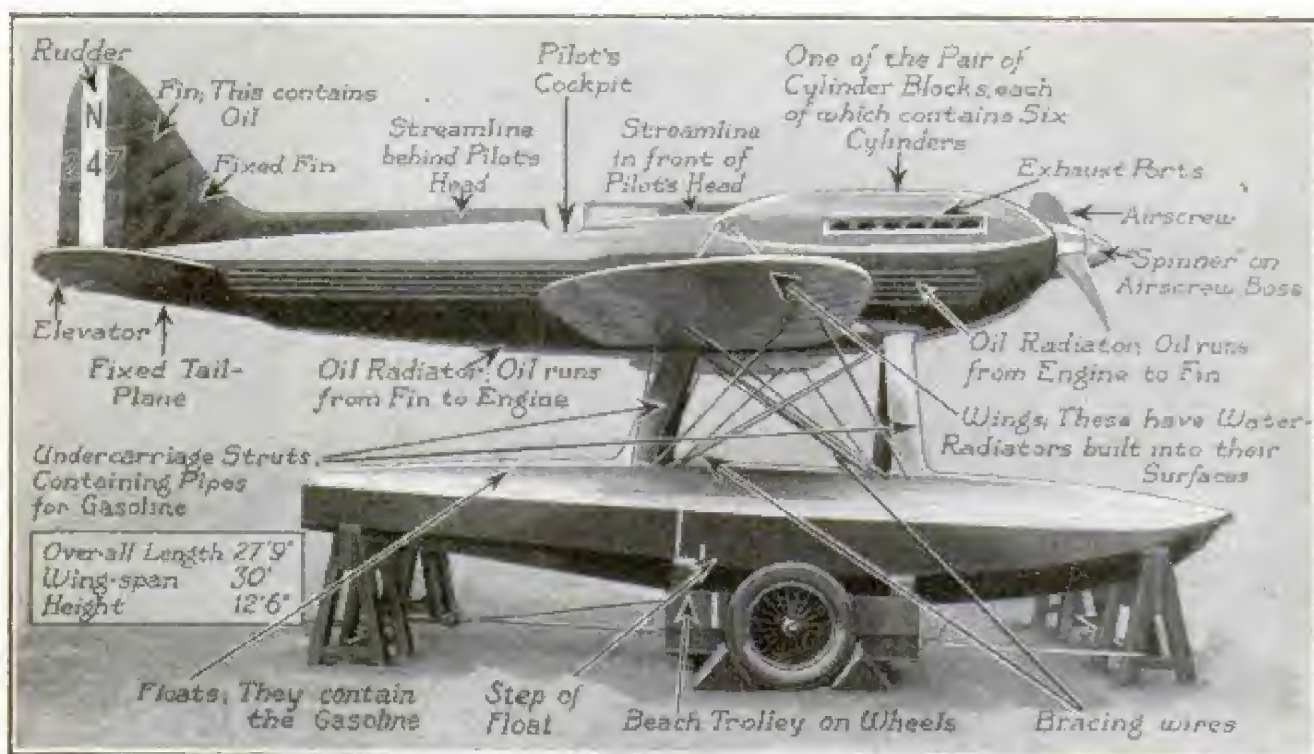
By CHRISTOPHER SPRIGG

A TINY blue and white monoplane, its pontoons, each almost as big as its fuselage, glinting silver in the sun! Inside, cramped, masked and goggled, the pilot moves at a speed man has never touched before—and lives! Filling the heavens with sound, the deafening boom of his engine, its supercharger gulping fuel at the rate of two gallons a minute!

Behind it a still smaller, blood-red monoplane, missing death by hair's-breadths as it strives in vain to catch the silver seaplane, skimming the water so that the un-supercharged engine might suck a mixture one iota denser than that of its rival. The pilot, fighting against unconsciousness while the cockpit fills with air tainted by the exhaust gases! Below blue water,

above blue sky, and around, on the golden sands of the coastline, more than a million people, their eyes riveted on the spectacle.

So was history made in the Schneider cup race this year, held in England and christened the greatest event in mechanical sport. For two years the most brilliant aeronautical brains of four countries had worked to produce aircraft that would be triumphs of modern mechanics. Day in and out motors roared on test benches, and engineers peered into wind tunnels, testing, verifying, experimenting. Italy expended \$5,000,000 for development. England spent \$1,000,000 on one engine. France allocated \$1,800,000 for her racing aircraft.



Unusual Features of the Racer as Shown by Diagram; the Floats That Carried Gasoline, Water Radiators in the Wings and an Oil Chamber in the Fin

On the day of the race gathered the skilled pilots who were to stake all, in one breathless hour, on the brains and skill of their engineers and mechanics. Some had already confessed defeat. France avowed that her machines had not developed the expected speed, and withdrew. Italy sought a postponement, but it was decided that the rules forbade. Lieut. Alford Williams, famous American ace, playing a lone hand, was unable to get his Mercury racer ready in time, and so England was given no chance to meet again the rival who had twice defeated her.

The Italian entries were two Macchi 67's. These were low-winged monoplanes, with sixteen-cylinder motors arranged in three banks. More than 1,200 horsepower, it was rumored, was crammed into each of these engines. Nestling beside them was the Fiat, the trickiest aircraft ever built. Only Sergeant Agello, the undersized Italian pilot, could climb into it, and it fitted him like a glove. Already this type had killed one pilot and injured another, for its controls were as light as a feather and it landed at 125 miles per hour. Its motor had two banks of six cylinders each. And its wings were mere stubs. Near by was the most extraordinary speed craft ever built, the Savoia-Marchetti racer. It had no fuselage or tail, for two 1,000-horsepower engines were placed

back to back and between them the pilot sat, with a propeller in front and another aft. Two booms from the side stretched behind each side of this propeller, and carried the control surfaces which would in a normal aircraft have formed the tail.

Then there was the British supermarine "S-6," a craft with a mystery motor. This was the new Rolls-Royce, never flown in a race before, with two banks of six cylinders each, supercharged, and with a geared-down air screw, which, it turned out, developed some 1,600 horsepower, making it the most powerful gasoline motor ever built. Wings as well as fuselage and pontoons were of metal, and the gas was carried in the pontoons. Cooling water from the motor ran between two skins of duralumin forming the outer skin of the wings. Oil, to be cooled, passed along the fuselage to the hollow tail fin and back to the engine. Contrary to Italian practice, both machines had the whole fin above the fuselage, claiming it gave better stability at high speeds.

After winning the race in his supermarine at a speed of 328.63 miles an hour, Flying Officer Waghorn was asked how it felt to fly at six miles or more a minute.

"Well," he answered, "I wasn't dizzy at the turns. The only unpleasantness came from the heat fumes and oil splashes from the engines in the cockpit. My impression

of speed was from the shipping flashing past underneath. I hadn't time to think of anything but the controls."

Sitting almost on the floor incased in a cockpit of duralumin, Waghorn had just about shoulder room and no more. The vertical control stick, the nerve center of the craft, was gripped between his knees. So delicately balanced are these high-speed machines that if one float is damaged when the plane hits the water at the 100-mile-an-hour landing speed, death may easily overtake the pilot.

"A new ventilator, fitted to the seaplane the night before the race," said Waghorn, "did a lot to free the cockpit of the stifling exhaust fumes which smother the pilot and blacken his windscreen. Down below in the float I carried 100 gallons of gasoline, a weight of 700 pounds, which would be all used up in an hour or less."

On a level with Waghorn's eyes was a long funnel-shaped window, giving him a sight along the engine cowling. A few minutes before the starting gun boomed, Waghorn, his ears stuffed with thick wadding to keep out the roar of the engines and propellers, squeezed into his cockpit. Mechanics fastened and bolted the window above his head, making him a prisoner in what might have been a steel coffin had anything broken under the terrific strain.

Another young pilot of the British team describing his sensations said: "If you turn very rapidly you may experience a 'black-out.' You may become blind because the blood has been taken from the retina of the eye owing to the centrifugal force. This only lasts for a moment, and when the turn is over you can see again perfectly well." After the victory, one of the British planes bettered its record by making 365.1 miles per hour.

What is the use of this great sporting



Top to Bottom, Squadron Leader A. H. Orlebar in Supermarine Rolls-Royce "S-6"; Front View of Italian Entry, and Lieut. Dal Molin, Who Was Forced Down

event in the world of aviation and its future? Traveling at Waghorn's speed one could reach New York from London in nine hours.

ficient force to kill rats, rabbits, squirrels or other small game at a distance of seventy yards. The new gun is compressed much like the ordinary air rifle, one compression being sufficient for from one to five shots. The weapon is a single-shell gun, firing shells loaded with slugs from "BB" to 10 size. The slugs scatter much as the charge of a shotgun does.

FLYING YACHT HAS OPEN DECKS FOR PASSENGERS

A four-engined twenty-four passenger flying

yacht has been ordered in Germany by Gar Wood, the famous speedboat builder. The most novel feature of the craft will be two open decks for the use of the passengers when the flying boat is at anchor or taxiing on the surface. The after deck will be eighteen feet long and the forward deck ten feet, and both will be eight feet wide, which gives some idea of the enormous size of the hull. Each of the four motors will develop 600 horsepower. Doctor Dornier, constructor of the giant flying boat "D-X," is the designer and builder. Mr. Wood learned to fly more than a year ago, and, in addition to his collection of racing boats and cars, has a seaplane hangar built into his home at Detroit.

CAMERA PICTURES EYE BALL AS IT FUNCTIONS

Eyes, the best cameras in the world, themselves now are made the objects of photography with a camera made by a German which pictures the ball of the eye as it functions. The

eye camera requires only one-twentieth of a second for exposure.



This House Is Made of Newspapers as Are the Desk and Chair; Lower Right, a Wall Section

HOUSE BUILT OF NEWSPAPERS PROVES SUBSTANTIAL

To demonstrate a novel use for old newspapers, a Massachusetts man with the aid of his family has constructed a cottage of newspapers and stocked it with furniture of the same material after eight years of patient labor. Some 65,000 daily papers went into the house besides several thousand rotogravure sections which form a colored border around the tops of the rooms. The walls are made of 215 thicknesses of newspapers, pasted and folded, and subjected to a pressure of about two tons, the surface being strengthened with three coats of varnish. Roof shingles also are of paper, but floors, rafters and window and door sills are of wood. The furniture is made of papers in cylindrical form, having the appearance of bamboo. Among the pieces are a settee, an octagonal table, a floor lamp, chairs, bookcase and radio. One desk is made entirely of dailies containing accounts of Colonel Lindbergh's Atlantic flight.

AIR SHOTGUN SHOOTS SHELLS INSTEAD OF SINGLE SLUGS

Actuated by air pressure, a shotgun is on the market which shoots shells instead of single shots. The gun requires neither oiling nor cleaning and shoots with suf-

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Elis H. Steinman, Mass

see April 1931 607

metalbauer, mederschaper, esermary

EFFECT OF OCEAN CURRENTS ON CLIMATE SHOWN

Contrary to the warm Gulf stream, which renders northern Europe mild even in winter, the Humboldt or Peruvian current is blamed for the barren and arid seacoast of Peru. There ordinarily is no rainfall and the climate is temperate, in spite of the tropical location. This is due to the current flowing northward from the icy Antarctic. About once in a generation, however, there is a conflict between this current and a warm equatorial current called El Nino. In 1925, the latter was victorious, rain fell and the Peruvian coast desert turned green and crops were abundant. Ever since, however, the Peruvian current has ruled.

MOTOR BUS CHANGES ENGINES LIKE A RAILROAD TRAIN

Detachable engines are being used in the motor coaches of a western bus line, this feature enabling a change of motors at division points. The engine may be demounted, taken from its hood, and another installed in twenty minutes. Hood and bumpers are removed, after which the motor bolts are loosened. The engine is moved from the coach with a winch. Gas,



Motor Coach with Detachable Engine, the Motor Being Changed at Division Headquarters

battery and water lines are disconnected and the motor is taken to the shops to be repaired or adjusted. Adjusted motors are kept at major stops, so that in case of a breakdown, one may be sent to a stalled coach and put in at the roadside.



A Shopping Bag Which, When Empty, May Be Used by the Marketing Housewife as a Cushion

MARKET BAG BECOMES CUSHION WHEN IT IS EMPTY

Serving the double purpose of market bag and seat cushion, a padded container is proving popular with the housewife who desires to go to a ball game or movie before she does her shopping. The sides are padded and the covering is of waterproof material. When empty, it makes a comfortable cushion, and when filled it becomes a light water-tight container.

LOCUSTS STOP PLANE MOTOR

Locusts, against which airplanes have been waging war in India and Egypt, have succeeded in instituting retaliatory, although accidental, maneuvers. One pilot in India who went up to scatter a swarm of the insects was forced down and found one of them had been drawn into the air-intake pipe. Other flyers have been forced to descend after the locusts filled the radiators and the engines started overheating.

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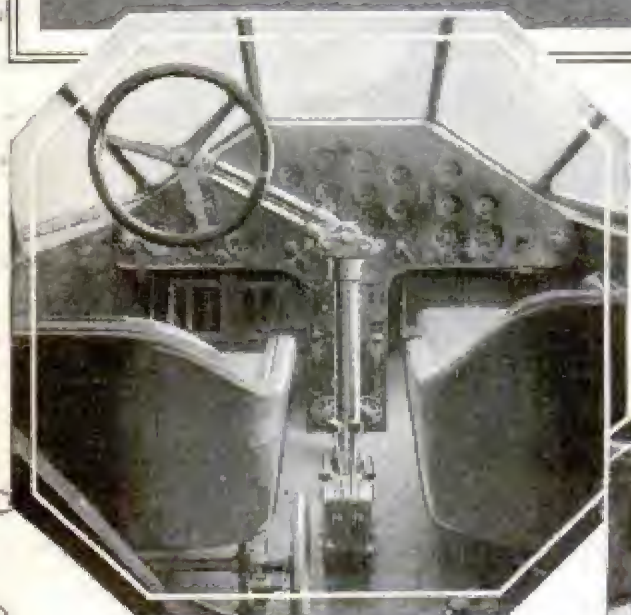
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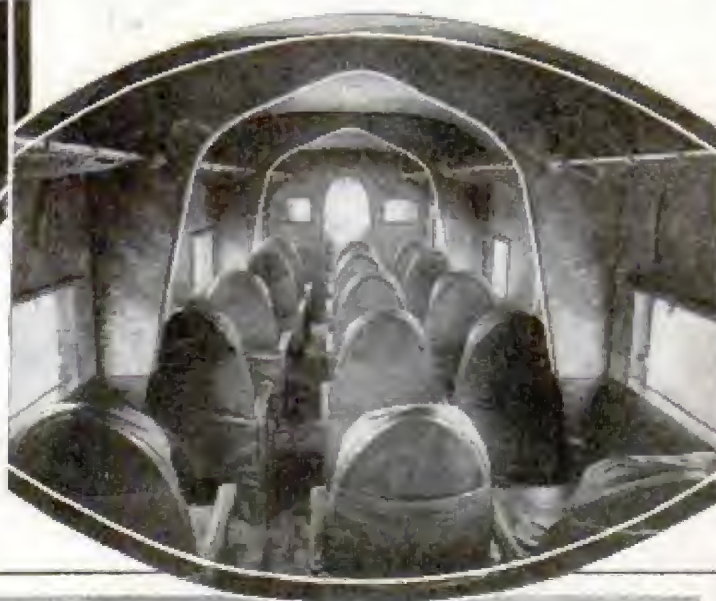
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TWIN MOTOR LINER'S CABIN HEATED WITH STEAM

Curtis Flying Service, 27 W. 57th St. New York



The Enormous Size of the Eighteen-Passenger Curtiss "Condor" Transport Plane Is Well Illustrated by the Photograph Above; the Ship Has a Wingspread of Ninety-One Feet Eight Inches and Is Powered with Two Instead of the Usual Three Motors; It Carries a Useful Load of Over Three Tons and Has a Cruising Speed of 116 Miles an Hour



Pilots' Cockpit Showing Hinged Control Wheel; View of Cabin Which Has Steam-Heated Radiators, and, Below, the Mighty Condor in Flight; It Can Climb and Maintain an Altitude of More Than 5,000 Feet on Only One Motor and with a Load of 17,378 Pounds



ALL PARACHUTES MUST PASS UNCLE SAM'S TESTS 3586

Manufacture and use of parachutes for airplane passengers and pilots are soon to come under governmental regulation. Makers will be required to submit samples for test, and none without approval certificates may be sold. To pass the tests, the parachute must open fully and function properly when dropped from a 150-foot altitude, carrying a 200-pound dummy. Then it must be dropped ten times from 500 feet, with the same weight and with three twists purposely put in the shroud lines. It must untwist and open fully before reaching the ground. Next, the same parachute is to be dropped five times from any convenient altitude carrying an 800-pound lead weight, more than four times the weight of an average passenger. If it gets through all these tests without damage, three "live jumps" must be made from 2,000 feet, with a rate of descent not to exceed eighteen feet a second, and a landing without discomfort to the jumper. The parachute must be fitted with a quick release by which the user can step out of the harness as soon as he lands, a provision required to take care of landings in water, where the jumper must be able to free himself instantly.

RIGHT OR LEFT TURN INDICATED BY AUTO SAFETY SIGNAL 3568

Combining a right and left-turn signal, stoplight, spotlight, parking-light and rear-view mirror in one auto accessory is accomplished in a safety signal now on the market. The signal is installed at the left corner post of the car, and extends the width of the running board. On the inside, next the wheel, is the switch box and control handle. The stoplight is connected with the brake, the others being operated by pressing a button on the switch box. All signals are visible from the front as well as the rear of the car, giving warning of driver's intentions, while the spotlight is adjustable to any angle, which can be done from the inside of the car.



An Auto Accessory Combining Right and Left-Turn Signals, Stoplight, Spotlight and Mirror

Boltan Safety Signal Co.



This Apparatus Detects the Amount of Combustible Gases in the Air of Mines and Factories

DANGER OF EXPLOSION SHOWN BY GAS DETECTOR

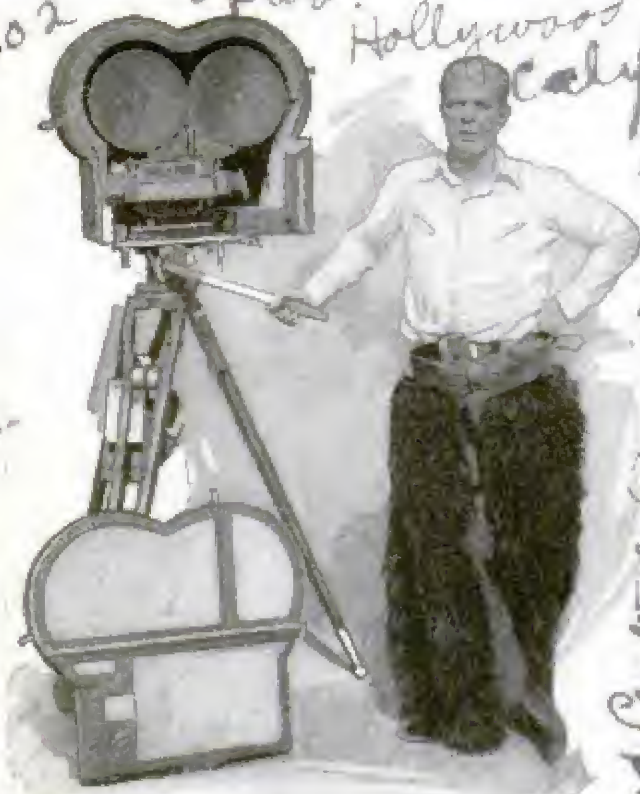
Quick, accurate and safe detection of combustible gases and vapors in oil refineries, mines or factories is afforded by a simple gas indicator designed after the instrument for finding fire damp in coal mines, but capable of wider application. The indicator consists of a detector head, a meter and a storage battery. Its working principle is the effect of combustion of inflammable gas and air mixtures on the surface of a glowing filament, the combustion increasing the temperature, and consequently the electrical resistance, of the filament. This causes the meter needle to move over a scale from which readings are taken and referred to a chart which shows gas conditions. The detector head may be lowered into a suspected chamber alone, or the apparatus may be worn by an observer who descends into the chamber to make the test.

The detector head may be lowered into a suspected chamber alone, or the apparatus may be worn by an observer who descends into the chamber to make the test.

Carbide Co. Michigan
230 N. Michigan
Chicago

3602

Blind Hollywood Calif



Built of Sound-Deadening Materials. This Movie-Camera Hood Is Being Used for the Talkies

"BLIMP" MOVIE CAMERA STOPS NOISE IN TALKIES

To smother the sound of operation of a moving-picture camera without the necessity of placing both camera and operator in a sound-proof "ice box," a shield resembling a hood for the camera is being used in Hollywood studios. The covering for the camera, when used for talkies, is known as a "blimp" and is constructed of sound-deadening materials, including yucca wood, soft rubber, felt, velvet and wood fiber. The blimp is cheaper than the large boxes in which cameras have been inclosed heretofore to make them sound-proof, and gives greater flexibility in the use of camera angles. It also improves photography by eliminating the plate-glass windows of the ice box, which shut out part of the actinic rays so necessary to photography. The hood weighs about forty pounds.

SOIL STERILIZED WITH STEAM TO CURB EARTHWORMS

By sterilizing the soil with steam, earthworms, which often cause damage to potted plants and other growths in greenhouses, are effectively curbed, workers at the Illinois agricultural experiment sta-

tion have found. The steam method was the most satisfactory of all tested, but good results also were obtained by watering with corrosive sublimate, one ounce in ten gallons of water.

TRAFFIC LIGHTS FOR PLANES TO AVERT ACCIDENTS

Traffic lights for airplanes, similar in operation to the red and green stop-and-go lights governing automobile traffic, are being installed at a Los Angeles airport to avert collision between arriving and departing ships at night. The signal is a large octagonal frame mounted on a fifteen-foot post. Reflectors, thrusting outward from its sides, face alternately up and down and each row of reflectors has alternating lights so that, when the red light is on in the upward-facing row, the downward beams are green. An arriving plane, if given the red light, knows that another ship is about to take off and stays clear until it gets the green lights, signaling the field is ready. In like manner, the pilot on the ground will not take off while the beacon's rays facing downward are red. The signal revolves, and there is a flasher light in the center. The beams are visible 1,000 feet in the air and 2,000 feet from the field.



Model of Traffic Signal for Planes: When Downward Lights Are Green, Opposite Ones Are Red

Used by Hood Lubson

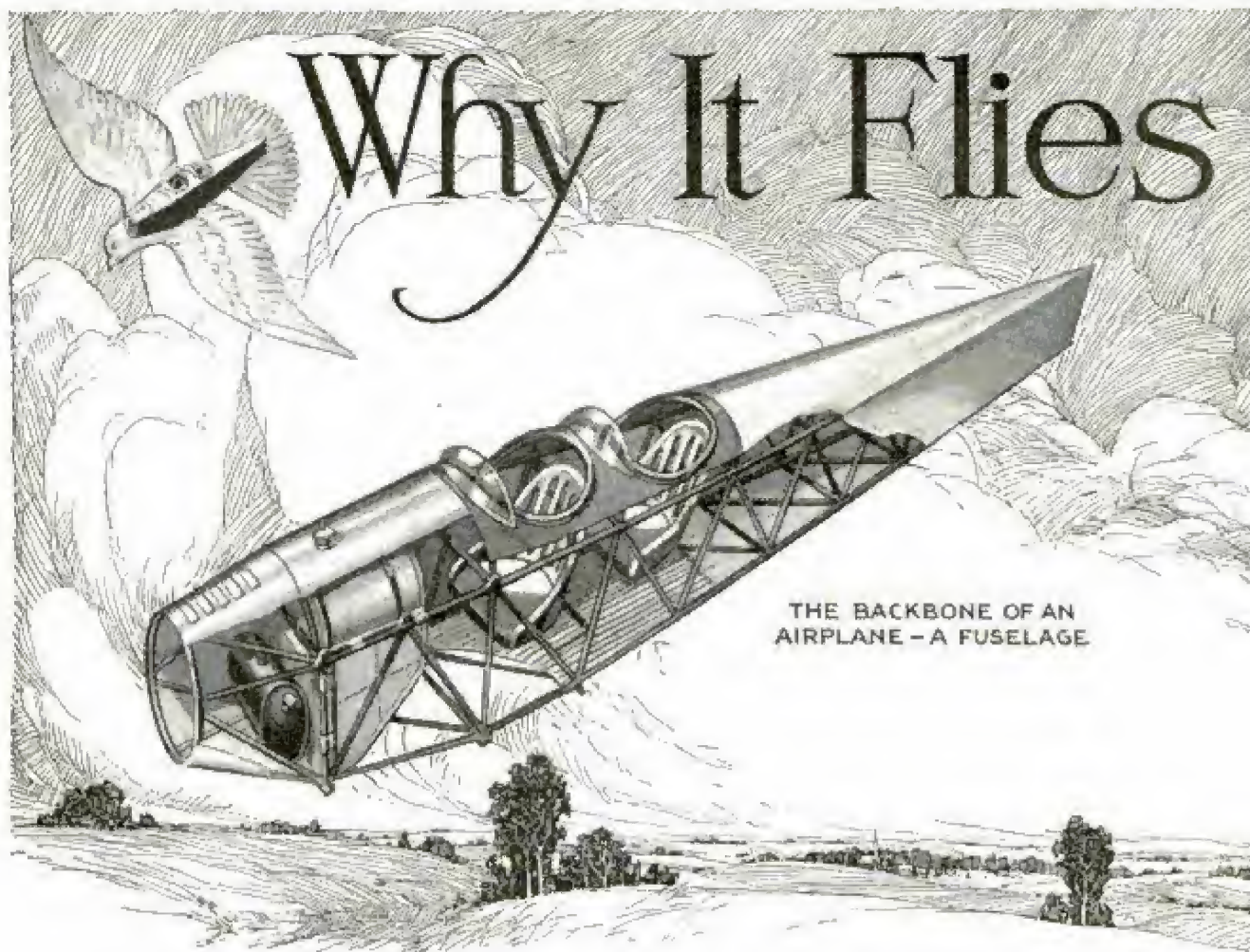
State Natural History Survey 351 Mrs. Urbana D. H.

Grand Central Air Terminal

11 N. Ave 24th, Los Angeles Calif

see letter in misc. file

Ind. C. A. - Islock Farm Traffic Signal



By MAJ. REED LANDIS

Famous Flyer and War-Time Ace

WHY does an airplane fly? Though the world last December joined in celebrating the twenty-fifth anniversary of the Wright brothers' first flight at Kitty Hawk, N. C., the principles of successful flight remain more or less a mystery to many laymen.

After all, there is nothing mysterious about a plane. You can find most of its parts in a bird, a boat and a fish. There are the wings and tail and the body of the bird, the rudder of the boat and the keel fin of a boat or back fin of a fish. Add an engine and a propeller to offset your inability to move your wings, as a bird does, and you have a flying machine, or omit the engine and propeller and soar on rising air currents, as the bird sometimes does, and you have a glider.

Whether that flying machine is the best that can be built nobody as yet knows. For years there has been talk of helicopters, ornithopters and orthopters, the first being airplanes which fly straight up and

hover in the air, and the latter two types of machines with flapping wings. A brilliant Englishman once exclaimed that an ornithopter represented the designer's idea of how a bird's wing works, and an orthopter was the designer's idea of how a bird's wings ought to work. But after all, one doesn't really want a helicopter; one doesn't want his airplane to take off vertically from the housetop and land on the roof of the movie show. It may do those things, but their disadvantages outweigh the advantages. Would you prefer to fall slantwise or straight down? A gliding landing will always be the easier.

But why does a ship fly? Take one apart, in your mind, or, better still, build one up from the ground. We'll start with a body for our imaginary ship. It's going to be a body of welded steel tubing, somewhat similar to the skeleton of a bird. Back of the engine we will install a gasoline tank, and then an instrument board and two seats, and behind them carry the



fuselage in a long streamlined tail. That much of our ship in shape and proportions resembles the body of the bird. Next we want a landing gear on which to mount it. Instead of the bird's two feet we will add a pair of wheels, on suitable struts. Next comes the wing, just like the bird's wing, except that it is immovable. In the big planes, our own Ford-Stout air liners, for example, the wing is built up of metal, internally braced and fairly thick—thick enough, in fact, to contain within it the gasoline tanks and baggage compartments. In any airplane, the shape of the wing is a matter of the utmost importance. In general, a modern wing is expected to lift from eleven to fifteen pounds for each square foot of surface; so the size of the wing depends on the weight of the ship, engine, fuel supply, pilot and passengers, or pay load, to be carried.

Next we will add the tail surfaces, of which there are four. First comes the horizontal stabilizer. It is really a small wing, but is not generally intended to exert a lifting effect. Instead it gives the plane longitudinal stability, as the rush of air sweeping back from the propeller tends to keep it in the same plane as the fore part of the ship, that is, keep the airplane in level flight. In most ships the stabilizer is adjustable over an arc of a few inches, and can be set while in flight to balance up the distribution of the load and make the ship easier to fly.

But we will not always want to maintain level flight, for our ship must go up and down, so, at the rear edge of the stabilizer, we hinge a pair of small wing surfaces called elevators and hook them, with proper control cables, to our control stick in the pilot's compartment. The controls are so arranged that if we push the stick forward the elevators tilt down, and if we pull it back they tilt up. What happens then will be explained a little later.

Another fixed surface is needed at the tail to keep the ship on a straight course. This is a vertical fin, rising up from the fuselage, like the back fin of a fish. Sometimes, instead of being parallel to the longitudinal axis of the plane, the vertical fin is set at a slight angle. The reason is that every single-motored plane has a tendency to turn on one side because of

the torque of the motor. To offset this tendency, one of two things must be done, either the pilot must always carry a certain amount of opposite rudder, or the fin may be set at sufficient angle to just overcome the turning impulse.

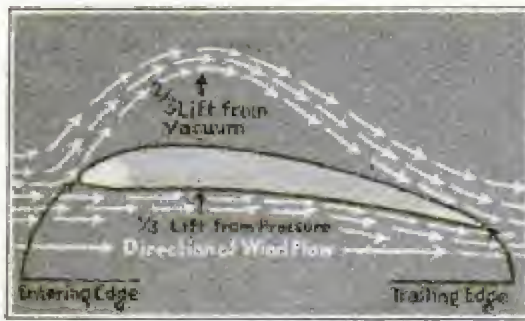
The rudder completes our tail assembly. It is hinged to the vertical fin and moves between the pair of elevators. It works just like the rudder of a boat, for when it is turned one way or the other, the rush of air striking the exposed surface pushes the tail of the ship in the opposite direction, and the nose therefore points to one side.

We need one more control to complete our plane, before adding the engine and propeller. That one is the ailerons, by which we keep the wings leveled up when a gust of wind attempts to upset our lateral balance, or raise one and lower the other when we want to bank the ship on a turn, to prevent it from skidding, just as a fast automobile would skid at a turn on an unbanked road. When we build the wing, we cut away a portion of the rear, or trailing, edge, near either end, and here we hinge the two ailerons. To make the controls as simple as possible, the connecting cables are attached to the control stick, which is swiveled to move in any direction. Moving it fore and aft works the elevators at the tail, while moving it from side to side raises one aileron and lowers the other.

We have already seen how the rush of air striking one side of the rudder pushes the ship's tail in the opposite direction. The same power makes our elevators work. In normal flight the air currents flow smoothly over them, but when we pull the stick back the elevators are raised, the wind pushes the tail down, and the nose points up; when we push the stick forward the elevators are depressed, the wind strikes their underside, the tail is flipped upward, sending the ship into a downward course.

Pushing the stick to either side lowers one aileron and raises the other, decreasing the lifting effect of one wing and increasing that of the other, with the result that the ship banks, the wing toward which the stick is pushed dropping and the other rising. A bird gets the same result by warping its wings, but, as our





MORE THAN TWO-THIRDS OF WING LIFT IS THE RESULT OF SUCTION ABOVE AND THE REMAINDER IS PRESURE BELOW



THE PATH OF THE WIND AROUND THE FUSELAGE



AN IDEAL STREAMLINE

Pictures Courtesy Standard Oil Company of New York

plane wing is rigid, we use ailerons.

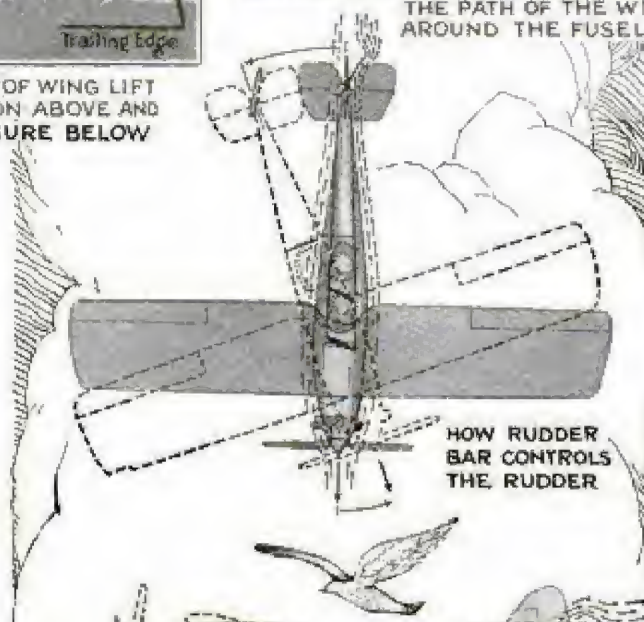
Add the engine and propeller, and our ship is complete. Abroad, the propeller is usually called an air screw, and the name is really better than our word, for it describes its action much more truly. It bores its way through the air just as a screw bores its way into a piece of wood when turned by a screwdriver.

Now that we have completed our ship, we are back to the original question: why does it fly? Stick your hand out of the window of a fast-moving automobile or train, tilt your palm slightly upward, and you will find your arm trying to rise. Or go back to your kite-flying days and remember how a kite, when tilted forward against the wind, starts to climb.

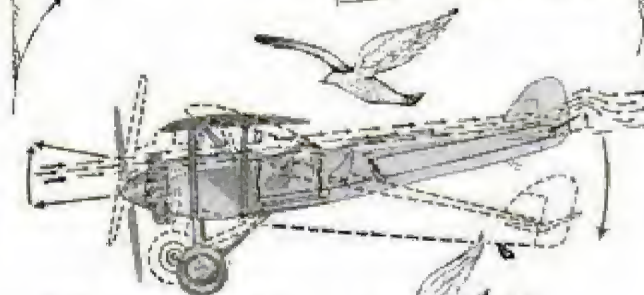
The same thing happens to our airplane wing when it is pulled through the air at high speed. How soon it will get off the ground depends upon the size of the wing in relation to the load, and somewhat upon its design. Some planes take off at thirty-eight to forty miles an hour, and some take off at sixty—the bigger

the load per square foot of wing surface the higher the speed must be to get off the ground and remain in the air.

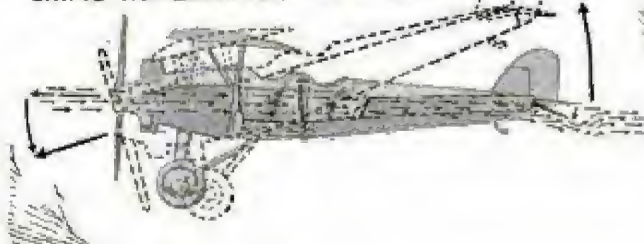
The lifting effect of the wing, however, is not, as so many believe, due to the air pressure on its underside. Actually not more than one-third of the lift is due to the pressure from below. The other two-thirds is due to a partial vacuum on the top of the wing, and here it is that good wing design plays such an important part. The



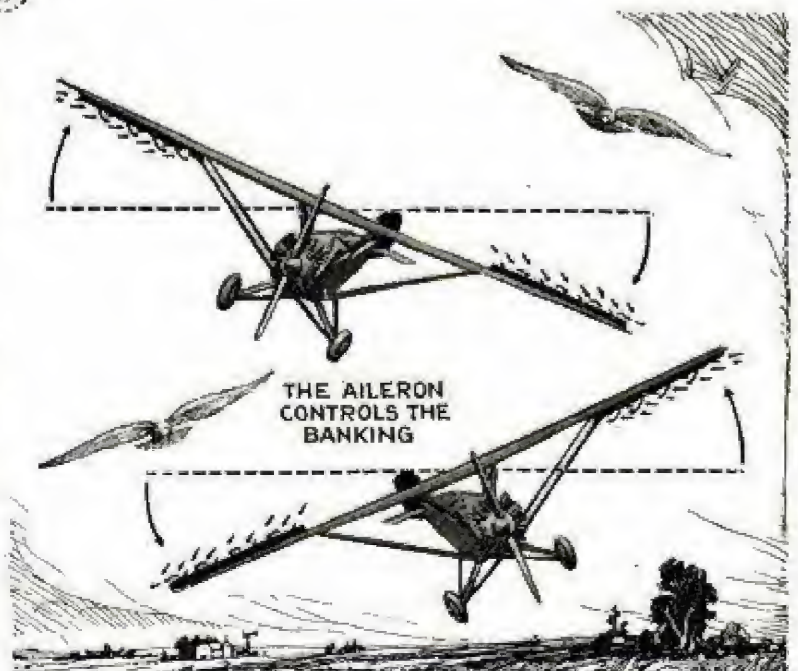
HOW RUDDER BAR CONTROLS THE RUDDER



THE CONTROL STICK SHIFTS THE ELEVATOR



THEAILERON CONTROLS THE BANKING



upper surface has a pronounced curve or camber. An air current rushing across this curve does not follow and cling to the surface, but rather is slightly deflected, and the air along the wing surface is drawn up into this higher-speed current, leaving a partial vacuum, into which the wing is pushed by the air below it, only to have the vacuum always keep a step ahead.

ARTIFICIAL-HAIL TESTS SHOW DAMAGE TO CROPS

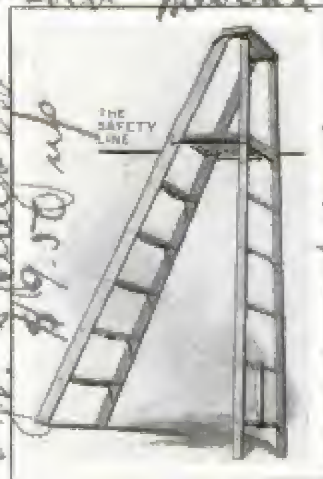
3575

Interesting facts concerning the damage to corn crops by hailstorms have been revealed in a series of tests at the Illinois agricultural experiment station. The effect of ~~real hail~~ was simulated by cutting the leaves and otherwise mutilating growing corn plants. It was found that clipping off the tip half of the blades was slightly worse than cutting out alternate four-inch sections on each side of the midrib. Each of these operations was more harmful to the plant than the loss on one side of all the leaves or the removal of half the number of blades. The tests were made in cloudy weather or in the evening to reduce injury from excessive water loss.

3571

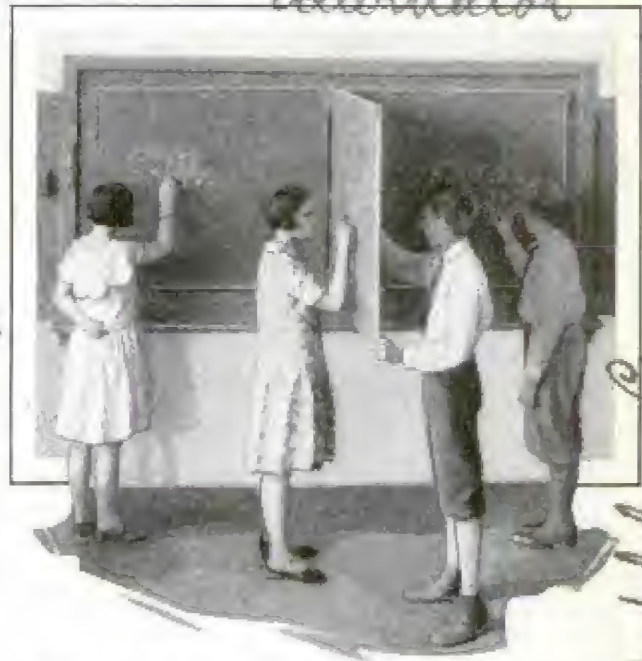
TOOL SHELF ON TOP OF LADDER GIVES ADDED SAFETY

Useful features of both ladder and platform have been combined in a safety-platform ladder now on the market. The ladder is of the spreader type with steps in the front and rungs in the rear. About three feet from the top is a substantial platform extending from the front to the rear rails. The top is fitted with slots for tools, nails or screws, and is hollowed out at the front so as not to interfere with the movements of the person on the platform. The ladder is held in position by a spreader near the platform and may be folded compactly for carrying.



BLACKBOARD FOLDS LIKE BOOK TO ADD WRITING SPACE

Alternator



A Swinging Blackboard Which Takes Up Little Wall Space but Gives Large Writing Area

Resembling a giant book, a swinging blackboard with four leaves, or eight pages, now is being installed in many schools. Such a board does not take up much wall space, but affords a large writing area. The leaves may be fastened firmly in any position, enabling four students to work at the blackboard at once by turning one of the leaves at right angles to the wall. It may also be suspended by a pipe framework where the wall type is not desired. Other advantages of the swinging board are that future work may be placed on it by the teacher, and permanent records may be kept on its leaves without risk of erasure. It may be adjusted so pupils obtain the best light and may be locked securely.

TRANSPARENT PRINTS TO SHOW COLOR COMBINATIONS

3589

Transparent prints are being employed to show the effects of various color combinations for automobiles, wall and floor coverings and clothing. A line cut of the object to be colored is printed with a solid background on transparent paper. Sample color cards are then inserted beneath the transparent print to show the actual appearance of the color combinations when applied to the article.

The Patent Scaffolding Co.

Miss B. R. Allen 273

Supply Co. 119 W. 8th St. Kansas City, Mo.
K. M. Mason
State St. Springfield, Mo.

CATWALK TO SUPPORT SUSPENSION-BRIDGE CABLES



Catwalks for the Longest Suspension Bridge in the World, Connecting New York City and Fort Lee, N. J.; on the Catwalks Are Being Spun the Cables to Support the Structure

Catwalks of the Hudson river bridge between New York City and Fort Lee, N. J., have been completed and on them are being spun the four thirty-six-inch cables which will support the central span of what will be the longest suspension bridge in the world. The towers are 635 feet high, with an additional eighty feet of temporary steel on top. The bridge will be 8,500 feet long, 120 feet wide and will have eight vehicular traffic lanes. The cost is expected to be \$60,000,000 and it is estimated that the bridge will be completed early in 1932.

LASTING PHONOGRAPH NEEDLE PRESERVES RECORDS

Eliminating the necessity of frequent changes of needles on the phonograph, a permanent needle now is on the market which, the makers claim, preserves the records and renders loud or soft music as desired. The needle is inserted in the sound shaft like the ordinary kind. Near its end is a small adjustment screw and, out of the shorter shaft, protrudes a fine

steel wire corresponding to the point of the ordinary needle. Lengthening or shortening this protruding part regulates the sound, and a range of one millimeter (one twenty-fourth of an inch) represents the difference between loud and soft music. The wire fits into the play groove, distributing friction equally instead of boring into the groove or scraping along the sides. A point too long or bent may be broken off the wire, after which it plays as before. The permanent needle is said to play 50,000 records or more without any attention other than adjusting it for pitch.



Ⓐ An unbreakable saxophone and clarinet reed has been made of aluminum, thus eliminating this annoyance as well as splits and warping.

E. Lynn, Beaver Falls

Weekly Express 9/26/29

Tried out in Paris Theatre

MAGIC-LANTERN STAGE SCENES LOWER COST OF SETTINGS

Two Austrian scientists have found a means of projecting stage scenery on a white background through an ordinary magic lantern in such a way that actors may stand within two feet of the scenery without casting a shadow. As far as the audience is concerned, the setting is indistinguishable from that made in the ordinary way, and the cost is much lower. A system was found for drawing the slides so that the lantern in the back wings need be only two feet in front of the curtain, the setting being projected at a sharp angle. In making the slides, it is necessary to work backward from the projection desired, and the slides resemble a meaningless jumble of lines and angles. In tests, persons in the audience were unable to distinguish real pillars from projections on the screen of similar pillars. It is expected the apparatus will make possible more scenes and a greater variety of them.

AUTOMOBILE RACK THAT TIPS REPLACES SERVICE PIT

Saving the installation of a more expensive service pit, an automobile rack that teeters like a seesaw now is being installed in garages. The rack is mounted on an angled base, so that when the car is driven onto it the apparatus tips forward to leave the auto in horizontal position, while elevation is afforded by running the car backward on the support, causing the rack to tip. It is used for alinement, brake adjustments, washing and greasing and has axle press, and axle and tracking gauges.

Teeterack



An Automobile Rack That Tips Forward or Backward, According to the Position of the Car

3604



A Rear Light Mounted on Luminous Card, Worn by London Pedestrians to Avoid Accidents

REAR LIGHT FOR PEDESTRIANS TO AVOID ACCIDENTS

Traffic in London is so congested that cautious pedestrians are equipping themselves with lights to warn motorists of their presence on the streets. One of the forms is a rear light, consisting of an electric lamp and reflector mounted on a luminous card that is worn on the back and is suspended by a cord from the shoulders.

PADDLING WATER KEEPS FISH ALIVE 3518

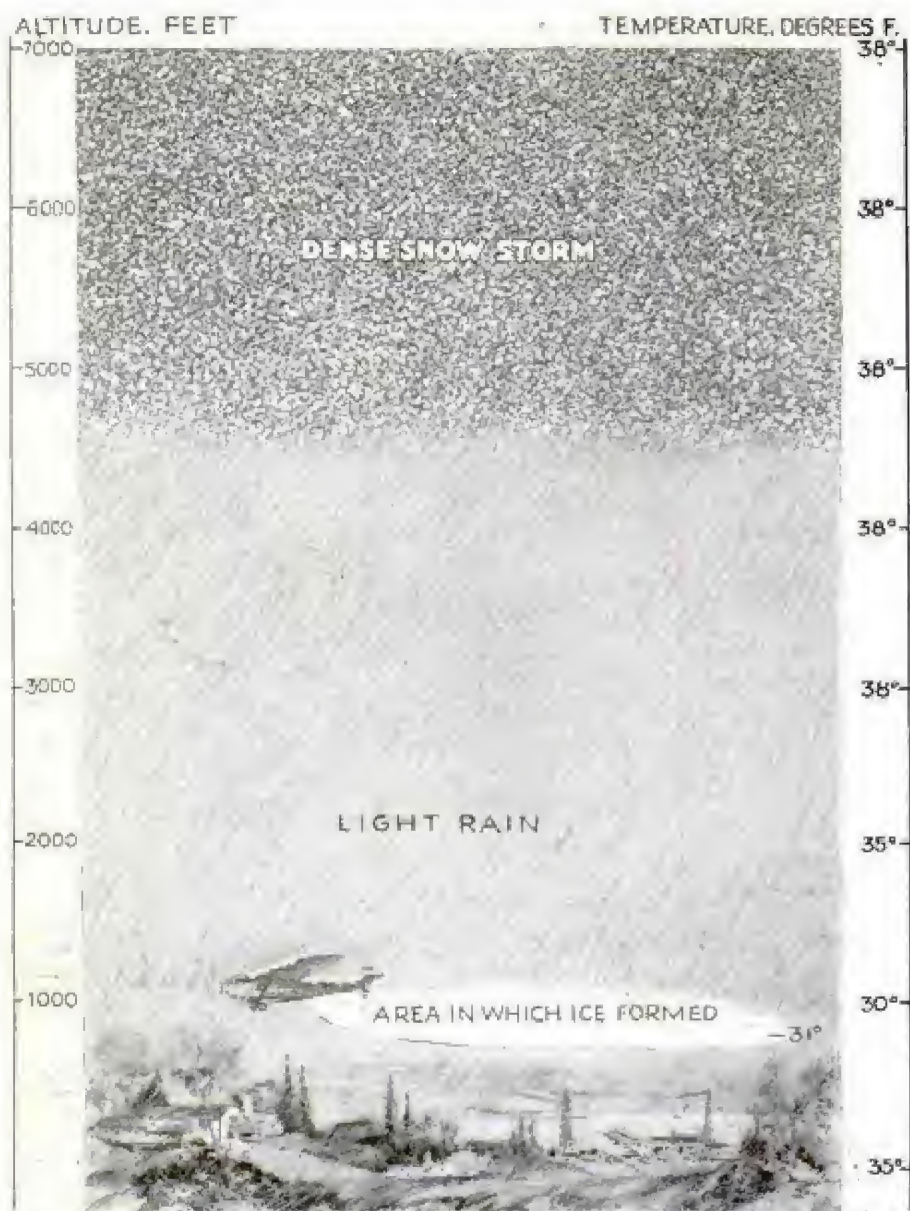
Chinese inventiveness is responsible for an effective, if unscientific, way of aerating the water in the large tubs where carp fry are being kept while being shipped. An arrangement of floats, which is operated by an attendant, paddles the surface of the water, and by this simple means sufficient fresh air is introduced into the water to allow the fish to breathe during the journey.

at Singapore

1944-815.00

Oscar Inf. Co. York

G. H. Cruikshank



Sketch Showing Conditions under Which Ice Dangerous to Planes Is Likely to Form on Wings and Fuselage

STUDY ICE FORMING ON PLANES FOR SAFER FLYING

Interesting tests conducted by the National Advisory committee for aeronautics at Langley field, Va., have revealed important facts concerning the menace of ice formation on airplanes while in flight. Aviators long have recognized the danger, as, under certain conditions, ice coats the edges of the wings and struts, "mushrooms" into irregular shapes and seriously impedes the flying efficiency of the ship or forces it down. The Langley field tests, performed with a plane equipped with special thermometers and surfaces for the more accurate study of the formations, further emphasized the ice peril, but, contrary to popular belief, the greatest haz-

ard, the experiments revealed, is confined to a limited range of temperatures and ways are available for avoiding the perils resulting from ice gathering, although adequate means to prevent the formation are not known. The real danger zone was found to lie in a narrow temperature belt just below thirty-two degrees Fahrenheit, when clouds, fog or rain were encountered. At thirty-one degrees, for instance, or slightly lower, dangerous clear mushroom ice was deposited. The tests showed that this menacing ice can be identified by its lack of color and that, by means of distance thermometers set in the wings and enabling the pilot to determine the temperature of the air through which he is flying, the danger zone can be avoided by going to levels where warmer or colder air will be encountered. At temperatures well below thirty-two degrees, ice gathered on the

plane, but it was pure white in color, more like snow, did not produce formations detrimental to flying and often blew off as fast as it gathered. Neither kind of ice presented a hazard due to extra weight, the experiments indicated, as the weight of the deposit practically canceled the weight of the fuel consumed. It was found that oil, grease, wax and paraffin were of little good in preventing the formation of ice; in fact, the substances were a greater hazard than the plain surface.

Popular Mechanics Magazine does not publish the name of the maker or seller of any device described in its pages, but this information is kept on file and will be furnished free upon application to our Bureau of Information.

THE NEW MOON AT SUNSET IN ALL CLIMES



ANTARCTIC

SOUTH TEMPERATE

TROPICS

NORTH TEMPERATE

ARCTIC

THE OLD MOON JUST BEFORE SUNRISE WOULD BE THE REVERSE, THAT IS, RIGHT AND LEFT (THE MIRROR REFLECTION).—FOR DIFFERENT LATITUDES WITHIN THE CLIMATIC ZONE AND, FOR DIFFERENT SEASONS OF THE YEAR, THERE WOULD BE SLIGHT VARIATIONS FROM THE APPROXIMATE POSITIONS SHOWN

Artists accustomed to inserting a new moon in a picture in the most artistic position often transgress the laws of nature, as the horns of the crescent moon must always point in a definite direction, depending primarily on the latitude of the observer. In the north temperate zone, the new moon as seen just after sunset always points upward and to the left. In this latitude the sun circles to the south and, as it approaches the western horizon, descends obliquely from left to right. The new moon, following the sun, takes approximately the same course, and since the horns always point away from the sun, they turn upward and to the left. In the southern part of the earth, the reverse is true, while in the tropics the horns point almost directly upward. The position of the old moon as it rises in the morning is the reverse of that of the new moon as viewed from the same latitude:

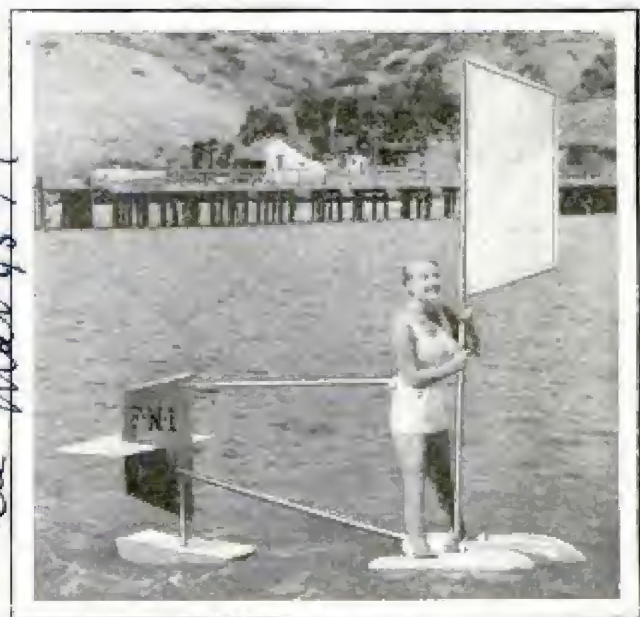
SYMPHONIES IN COLORED LIGHT PLAYED MECHANICALLY

Colored light may be made to sway, bend and sweep over displays or buildings by a control mechanism like a piano-player roll, the perforated paper fed into the apparatus making the color combinations. Dimming is accomplished without flicker, and the changes are made in a predetermined order. As the perforated paper roll passes the openings in a tracker bar, the functions of turning on and off circuits and the operation of the dimmers are performed automatically. The cir-

cuits operate independently, as does the dimmer, giving great flexibility of combinations. Manual operation is also provided by a console keyboard like that of a pipe organ.

WATER SHOES MAKE SAILBOAT FOR NOVEL SPORT

Water shoes in which the passenger stands upright form the basis for a sailing-shoe plane, or sailboat, in which the sailor's body becomes part of the craft. To the shoes is anchored a reversible sail, and a rudder, enabling change of direction of the craft by a movement of the body, while speed is regulated with the sail, is attached to the shoes and body.



A Nifty One-Passenger Sailboat, the Basis of Which Is a Pair of Oversize Water Shoes

before illumination by engineering society

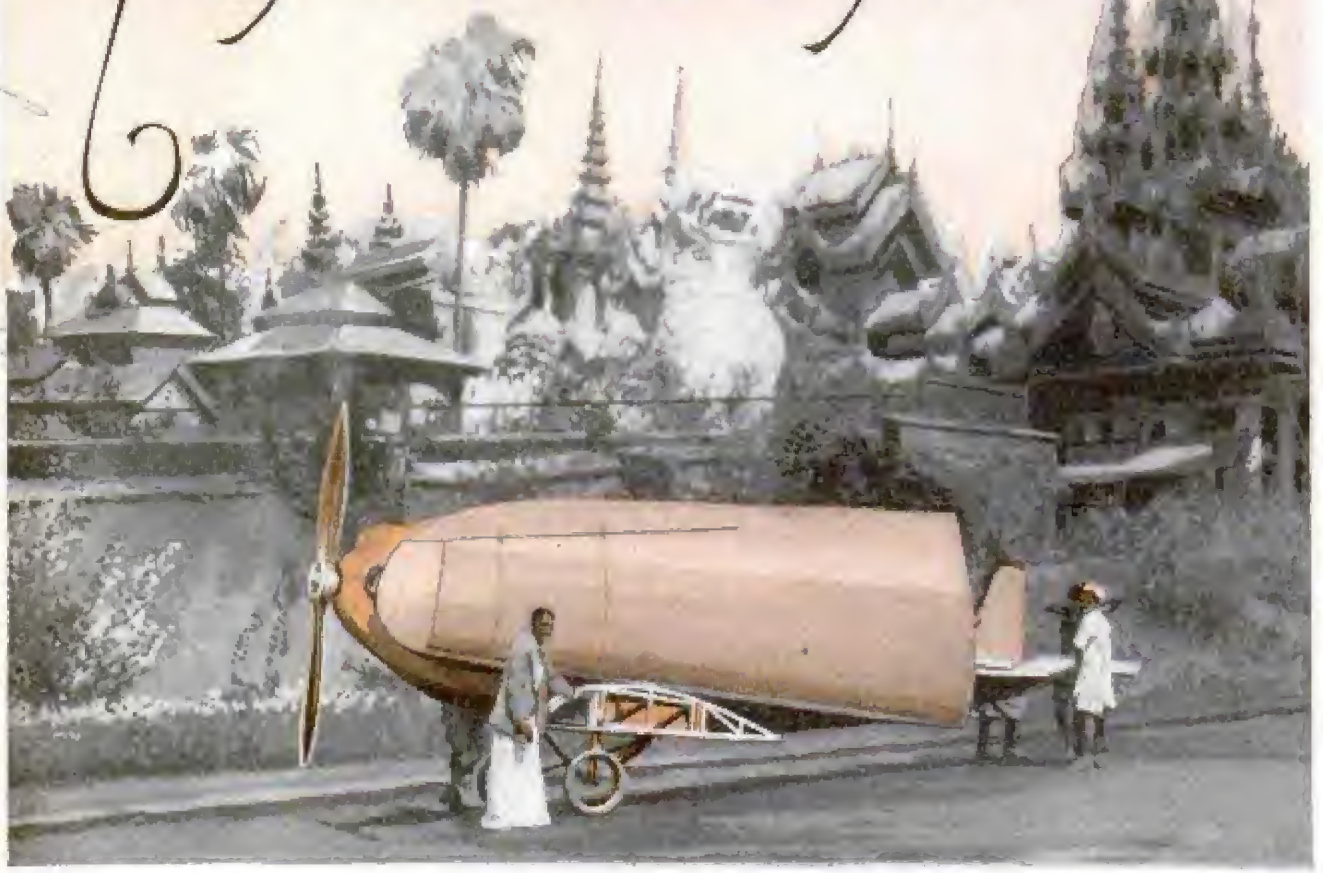
no further information sailboat with front view - 6 ft. long - on Scherker's Antennae 32d. Wabach Chicago

see max 457

I. J. Starr Chicago

W. W. Scherker

My Twin-Cylinder



The Two-Cylinder Ship in Which Baron Warthausen Circumnavigated the Globe Being Pulled through the Streets of Rangoon, Burma, with Its Wings Folded; the Little Plane Cost \$1,800

By **BARON KOENIG WARTHAUSEN**

In an interview with Andrew R. Boone

I HAD no intention of flying around the world when I took off at Berlin a year ago for a non-stop flight to Moscow. Yet the world called, and, as my little machine seemed thoroughly trustworthy, I went on.

Fashions in adventure do change. Two years ago, one attempting such a flight would have loaded his plane with all sorts of safety devices preparatory to flying over long stretches of water. I have undertaken no such hazardous flights. Mine is purely a private, sporting expedition, started as a one-day flight and lengthened into a year's world tour.

The fact that my little monoplane is powered with a tiny two-cylinder engine which develops a maximum of twenty horsepower should not cause you to think I am foolhardy in flying thousands of miles with such little power to pull me

along. It has proved quite sufficient, especially in view of the low landing speed of the plane. Seldom does it move more than twenty miles an hour when the wheels touch the earth, yet it flies easily at seventy miles an hour.

When I left Berlin in August, 1928, I had done only seventeen hours' flying, and I had never flown at night. Since the trip to Moscow would require sustained flight extending longer than the duration of daylight hours, I started at night, sure I could maintain a true course by watching my magnetic compass carefully.

Sure enough, when dawn broke, I saw the Baltic sea far on my right and knew I had not lost my way. When I reached Moscow I thought I might as well go on to Baku, and when I reached the Caspian sea I decided to fly to Teheran. I spent

paid to Aeromarine
Mem Corp
613 W. Jackson St
Chicago, Ill
3211

Flight Around the World

four weeks in the Persian capital, sight-seeing and awaiting the end of the Indian rainy season. As the only way to return was by air, I decided to fly to the Persian gulf and return by ship. I still did not want to turn back, however, and went on to Calcutta, Akyab, Rangoon and Bangkok.

Strangely, the only three incidents that slowed my progress at all occurred in Persia, during the early half of my flight. On one occasion, a downdraft, or descending air current, along a mountain range brought me to a forced landing while yet at an altitude of 8,400 feet, and on two other days a depleted petrol supply and a loosened gasoline



Above, the Twenty-Three-Year-Old German College Student, Who Set Out on a Day's Journey and Continued around the World; Below, Burma Natives Admiring His Tiny Plane

connection caused me to descend hurriedly, though these were not in a strict sense forced landings.

The worst of these befell me when the petrol supply became exhausted. I was flying between Shiraz and Bushire, in Persia. I left Shiraz with just enough fuel to complete the journey. I had to cross successive mountain ranges rising to 12,000 feet and I was afraid the machine might not be light enough to rise to an altitude of 14,000 feet, its maximum being 15,000. I flew at 14,000 feet meeting heavy winds. Just as I cleared the last mountain range the engine stopped—no more petrol! Fortunately I was able to bring the plane down to the desert and land near a small village, where I stayed with the local sheik until two men brought fuel on a camel.

In the same neighborhood, a severe downdraft along the side of a mountain range literally pushed me into the ground. My plane touched the earth at an altitude of 8,400 feet. I had never landed so quickly and effectively before. There I was—no food, no water and apparently far from habitation. While there was plenty of fuel in the tanks, I could not take off from the small area offered and could not pull the plane alone to an open space about a half mile distant.

So, I took to my feet and walked six hours down to a dry river bed, where I found a camp. There I got help and, more important, food and drink. Fortunately

I had taken the trouble when in the Persian capital to learn something of the language. My German, French and English would have been of no avail here. On the following day, with a group of Persians, I walked back to the plane. They helped me push it the half mile to a place where the sand was not so soft, and I took off again. The only other unforeseen landing took me down along the coast of Persia. A screw had worked loose on the gasoline line and my engine revolutions dropped from 2,900 to 2,700. Naturally I was not sure of the cause, and as I was then flying at an altitude of 300 feet, I felt it would be safer to descend and locate the trouble. Afterward, I continued my journey to Karachi. Had more serious trouble developed, I might have spent some time on that island. On another occasion I flew into a flock of thousands of flamingoes in Baluchistan. This presented the danger of a broken propeller, and I pulled away from the birds quickly.

I had a deal of luck in escaping these situations without undue delay and at times felt I was fighting for my life, especially since I was totally unfamiliar with the terrain. Very fortunately, good weather opened up ahead during nearly every day of flight. From Moscow southward, I followed the railway. Across Persia the general trend of the mountain chains guided me, and from the Persian gulf onward, the greater part of the route lay along the coast line.



Another View of Baron Warthausen's Ship at Rangoon, with Wings Spread for Flight; the Only Untoward Incidents of the Small Craft's Journey Were Three Forced Landings in Persia



Admiring Natives Who Greeted the Baron's Plane in India; His Trip Showed, He Declared, That the Peoples of All the World Are Familiar with Aviation as a New Mode of Travel

The little machine I fly is a low-wing monoplane, powered with a two-cylinder Mercedes-Benz engine. I bought it for \$1,800. Half of this paid for the engine, which was entirely hand-made. Although the motor develops no more power than a motorcycle engine and gives fifty miles to the gallon, it has had no serious mechanical breakdown throughout the journey. I had no thought of "blazing new trails." In all respects, the flight has been a pleasure trip made for my own enjoyment.

I hope, however, that it will have helped throw the world open to any flyer with a small machine and the necessary impulse. Since aviation has developed to its present state, countries are not farther removed from each other than cities once were. One attempting such a jaunt need not pursue dangerous courses. He need not fly over the sea. He usually can follow air routes of a sort and have reasonable assurance of reaching his destinations.

Wherein does the value of such a flight lie? It demonstrates what can be done with a light plane within the reach of modestly lined pockets. These small planes operate economically. Recently, on my trip from San Francisco to Los Angeles, the journey was made on \$1.80 worth of gasoline and oil. The plane's speed is sufficient. I was in the air on the Berlin-Moscow leg only fourteen hours and five minutes. Throughout my tour I will have seen only fifty flying days, cov-

ering in that time approximately 16,500 miles. It should be explained that the engine is geared down to the propeller at a ratio of three to one. The engine turns about twice as fast as the average American airplane motor, yet it is this high speed that develops sufficient horsepower in such a small power plant.

A plane of low landing speed manifestly is the best type for such a cruise. Low wings give greater stability close to the ground and enable a plane of low horsepower to get off with a shorter run. This is especially valuable, as one never knows just how small a space he may have to land in. Many times I have gotten my plane off in eighty feet. Its very light weight (560 pounds) has helped on several occasions, too. Such a plane can take off from a sand runway where a heavier plane would sink over the tires or nose over. The all-wood wings have given good service, being hung in such a fashion that they can be folded against the fuselage for storing or transportation.

Only five instruments are mounted on the dash. These include a small magnetic compass, air-speed meter, altimeter and tachometer (engine-speed meter) and a thermometer.

One of my most profound conclusions gained from the flight is that, while the world may not be air-minded in all regions, it certainly has become aviation-conscious.



Model of the First Commercial Electric-Light Plant,
Designed by Thomas A. Edison.

FIRST ELECTRIC-LIGHT STATION MODEL IN FORD MUSEUM

Built on a scale of one-half inch to one foot, a model of the first commercial electric-light station, designed by Thomas A. Edison, has been constructed for the Ford Museum at Dearborn, Mich., where Mr. Edison's achievements and the buildings in which he worked are being assembled or reproduced. This station was the Pearl street generating plant in New York, which started operation in 1882 and was destroyed by fire in 1890. The lower floor shows coal-handling equipment, furnaces and boilers, the next contains the six dynamos, each connected to a steam engine, and on the top floor is the bank of 1,000 lamps, used for testing and handling variations in the load. Each dynamo had a capacity of 1,200 sixteen-candlepower 110-volt lamps.

CAMOUFLAGE MAKES AUTOS CROW LIKE ROOSTERS

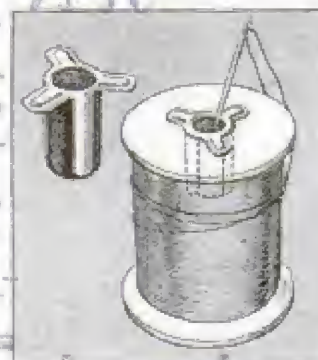
Automobiles with exhausts that imitated all the barnyard sounds from the crowing of roosters to the barking of dogs were used in recent sham battles staged by the British war department. The barnyard exhaust was placed on various war machines to deceive outpost scouts listening for movements of the "enemy" forces. Anti-tank machines were disguised to look like open-air food stalls, and

armored cars were built so low they could creep unseen along banks, while baby automobiles were used for scouting purposes in the field.

HARNESS WINTER SUN FOR HEAT TO CUT FUEL COSTS

Harnessing the winter sunshine for heat, to aid in cutting fuel bills, is being attempted by engineers who have found that the solar energy on bright winter days penetrates into artificially heated buildings with southern or southeastern exposure and raises the temperature from fifteen to twenty degrees. The engineers, attempting to capitalize this natural phenomenon, use a sunshine recorder as the exterior member of the solar heating plant. It contains two bulbs between which is sealed a small quantity of mercury. When sunshine centers on the bulbs, it acts on the mercury to complete an electrical contact, the circuit being linked to the thermostatic-control system regulating the artificial-heating plant. The arrangement is such that, during bright days, the heating plant will provide from fifty to sixty degrees of the indoor temperature required, leaving the sun to do the rest to maintain the indoor heat at seventy degrees. A saving of twenty-five per cent in fuel thus may be effected.

NEEDLE CUSHION FITS ON SPOOL TO KEEP SEWING IN ORDER



Needle and thread are kept together, without the necessity of running the needle into the tightly wrapped thread on the spool, by means of a needle cushion which is attached to the latter. The cushion is contained in a round piece of metal which slips into the hole in the end of the spool, and may be used repeatedly.

A power site of more than 20,000 horsepower has been discovered in Alaska by aerial survey.

ART OF MAKE-UP TAUGHT IN STRANGE SCHOOL



order to accentuate some peculiarity or characteristic of the person they are to represent. Wigs and costumes also are among the subjects studied. At the upper left is a man's face changed to represent a skull, while other pictures show operatic characters making up.



Believing that the preparation of stage make-up for the portrayal of character parts is an art in itself, a Berlin instructor has opened a school to teach embryo actors and actresses the fine points of impersonation. The students learn how to mix colors and how to apply them in

Pou



Flexible Life Raft Tossed Overboard; Right, Extended to Support Several Persons

FLEXIBLE LIFE RAFT HOLDS TWELVE

Compressed, when folded, into a space little larger than that occupied by the ordinary life preserver, a flexible life raft has been made, which, when extended, affords support for more than a dozen persons. The raft, when in use, unfolds to form a rectangle with cross supports to sustain the weight of those clinging to it.

ROCKET AIRPLANE HERALDS SPACE VOYAGING

Trips through space are forecast as a result of recent successful tests in Germany of a rocket-propelled airplane built by Fritz von Opel, who, a year ago, demonstrated a rocket automobile. Interesting as is the development, it is unlikely that rockets will ever displace combustion engines in terrestrial travel, or be used in planes flying in the lower portions of the atmosphere. The rocket has a low efficiency because it depends for its power on the kick given by the explosions, uses fuel very rapidly and is able to utilize only a small part of the energy created. In traveling through space containing less air than the vacuum of an incandescent-

lamp bulb, the situation is different. There no air, ground or water is available against which to push and the rocket is the only known means of propulsion. Because of the lack of atmospheric resistance, the kick of the



explosion in the vacuum would create more speed. Several years ago an American physicist startled the world by suggesting that a rocket flight to the moon would be possible in eleven hours, but his idea was not that it should carry a passenger, but only a charge of flash powder, the explosion of which on impact with the moon's surface, would be observable from the earth through telescopes.

HONEY AS SUGAR SUBSTITUTE SWEETENS ICE CREAM

Honey may be used instead of sugar to sweeten ice cream, tests at the Illinois agricultural experiment station have shown. Twelve kinds of honey were studied, the alfalfa and clover varieties seeming to have the most desirable flavor. The tests were successful on practically all kinds of ice cream except vanilla. Honey and vanilla do not blend well, the experimenters found. The honey ice cream was smoother but had a tendency to be somewhat crumbly.

watermelon investigation. Prof. May Valer
 3580

Life Raft

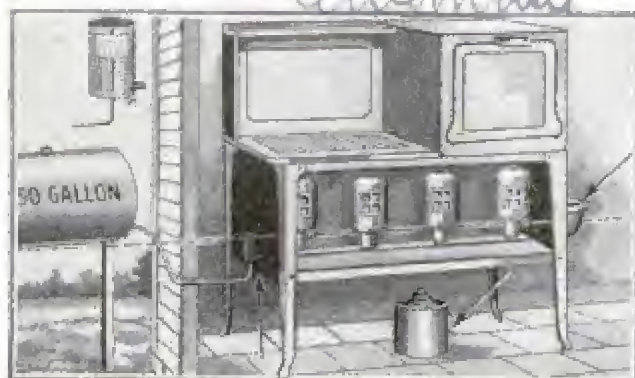
all year's progress in
 1914-1915 R. Robinson

THROAT PHONES TO ELIMINATE ROAR OF AIR MOTOR

Telephones for use in noisy airplane cockpits, where conversation otherwise would be inaudible, are arranged for attachment to the throat. A sounding piece pressed against the throat transmits words, in the form of larynx vibrations. Another improvement in telephone apparatus is an "iced" telephone receiver for hot-weather use by persons desiring to carry on a long-distance conversation lasting a quarter of an hour or more. The receiver remains cool for fifty minutes and is being tested in London.

OIL STOVE FILLS ITSELF FROM BIG TANK

Keeping the oil stove supplied with fuel is accomplished automatically with a kerosene feeder attached to piping connecting stove and oil tank. The feeder is a small cylinder with a float valve inside, the oil flowing by gravity from the tank to the feeder which regulates the amount fed to the stove by the float-valve arrangement. The appliance also may be used for incubators and brooders. At the bottom of the feeder is a faucet where kerosene may be obtained for other uses in the home.



The Small Cylinder with Float Valve (Upper Left) Automatically Feeds Fuel to Oil Stove



This Coal-Car Dumper Picks Up Car and Contents, Turns It Upside Down, and Sets It Back on the Track Upright

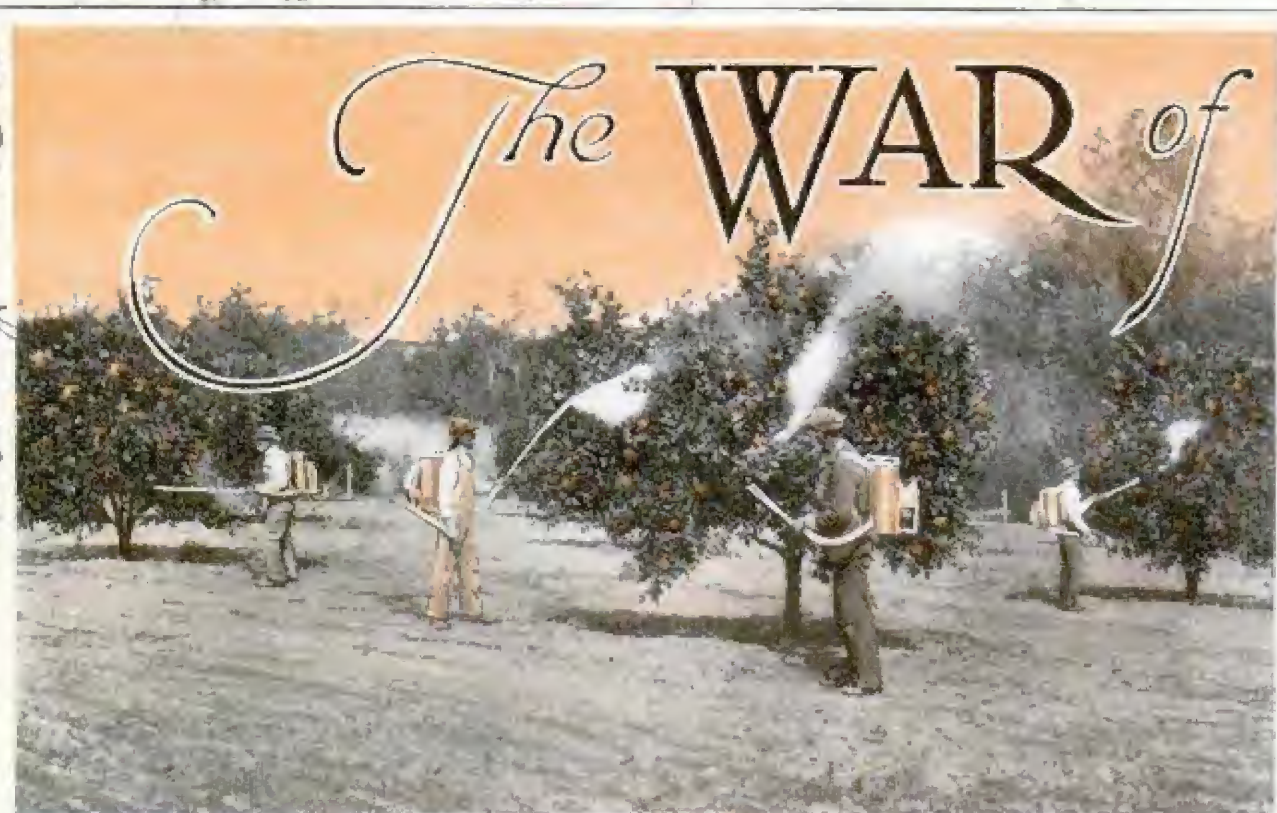
DUMPER OVERTURNS COAL CAR TO EMPTY ITS CONTENTS

Dumping coal cars has been simplified by a device used by one of the eastern railroads which picks up the car and its contents, turns the car upside down to empty the coal into a steel chute, then rights the car and sets it back on its rails, all in a few minutes. The dumper operates through a series of steel fingers which pick up the car and hold it firmly while it is turned over.

ALCOHOL MAKES LEAVES RED

Leaves turn red in autumn because of alcohol, according to Samuel G. Hibben, of the Westinghouse Lamp company, who has been investigating the matter. They age, and certain chemical products accumulate, among them various alcohols. These act on other substances in the leaves to make the bright-colored pigments.

Spray John Bear hfy C
Lansing, Mich



Spraying Citrus Trees in Polk County, Fla., Where More Than 5,000 Men Were Enlisted in the Warfare against the Destructive Mediterranean Fruit Fly

MAN and insect, bitter enemies, are about to discover who wields the balance of power on earth. It will mark the culmination of the longest-drawn battle known, the first engagement dating back to prehistoric times.

Following the footprints of explorers, the "domesticated" insects have spread as rapidly as the frontiers of civilization. The six-legged pests have ravaged crops, destroyed man's garments and injured his health so effectually that he is driven into open hostilities.

The latest cry of alarm comes from Florida. There, the most recent immigrant from overseas, the Mediterranean fruit fly, combats 5,000 fighting men. Unless the fruit fly is routed, its regiments may spread like a consuming flame to every state in the nation.

The work of quelling this pest may be judged from an expert's prediction that if one fly evades the quarantine, which is backed by an appropriation of \$4,250,000 from congress, every fruit-growing state in the union will suffer. Another possibility, not so remote, is that this species may ally itself with other insect tribes and wreak havoc in every country where it finds food.

In its size and general shape, the fruit fly resembles an ordinary house fly, but differs greatly in the color pattern of the body and wings and in its habits. The female fly punctures fruit skins with the sharp end of her body; through these tiny holes, she lays her eggs. Each egg is only one-twenty-seventh of an inch long; several hundred eggs may be deposited in one cavity by a succession of flies. They cannot inflict bodily injury to man. But the adult fly continually seeks fresh fruit in which to lay eggs. They die in three or four days if without food; if sufficient nourishment is at hand, they may live from 200 to 300 days. The department of agriculture has advised growers that the destruction of infested fruits and spraying are measures that should go hand in hand. Sprays are applied to kill the adults; fruits must be destroyed to kill the eggs.

The only certain, now known method of protecting plants against fruit-fly attacks is to cover them, when still very green, with ordinary cheesecloth sewed into bags large enough to be slipped over the tree and tied around the trunk.

Property worth \$1,800,000,000 is threatened by the fruit fly in the United States.

the AGES

A report from a committee of experts on the Florida front states that eradication of the pest is possible, and will be accomplished with sufficient financial aid.

Down the ages, mosquitoes also have tormented man. If they were merely bothersome, we would have justification for war against them. When we consider that a certain species found in the south will transmit yellow fever and breakbone fever, no further argument is needed.

Mosquito-breeding places are very diverse. Some species breed only in tree holes; others, in crabholes on sea beaches; still others, in any chance accumulation of water. The house mosquito in the north, the rain-



barrel mosquito and the yellow-fever mosquito in the south breed in every receptacle of water about residences.

Almost any refuse pile, or cavity where water can accumulate, is ideal for mosquito multiplication. They use even the footprints of cattle and horses for breeding, as well

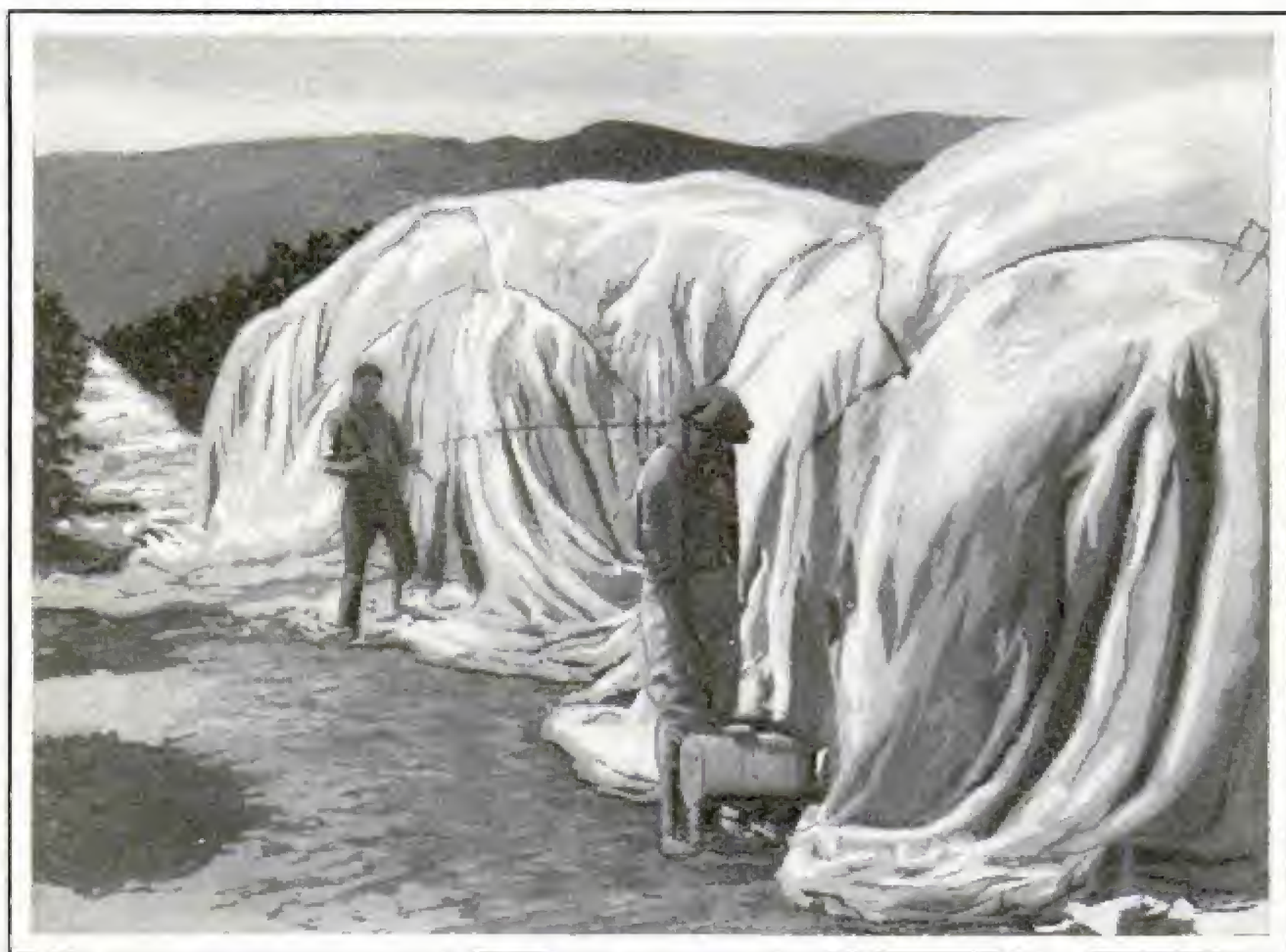
as places around water pipes, washbasins and fire buckets. Where water must be stored, it is advisable to use screens.

Spirits of camphor or pine oil rubbed upon the face and hands will help keep mosquitoes away, but a single application will not last all night. If not averse to the odor of oil of citronella, that also may be used effectively. A solution of one ounce of oil of citronella and four ounces of liquid petrolatum has been tried successfully. A few drops on a bath towel hung over the head of the bed will keep common house mosquitoes away. When they are abundant, a few drops rubbed on face and hands will keep them away.

A very satisfactory mosquito remedy is



Top to Bottom, Head of Digger Wasp; Robber Fly Killing Smaller Rival, and Pincers of Tiger Beetle



Fumigating Citrus Trees with Hydrocyanic Acid Gas to Kill Scale Insects; the Canopies over the Trees Insure a More Thorough Treatment

moist soap. Wet the end of a piece of ordinary toilet soap and rub it gently on the puncture, and the irritation will soon pass away. Household ammonia, alcohol or glycerine are effective, too. Holding one's hand near a hot lamp chimney will also relieve irritation.

Of about 500 species of fleas, less than one dozen are of importance in the welfare of man and the lower animals. The human flea, the dog flea, the cat flea, the stick-tight flea, hen flea and rat flea are the principal species that concern man.

In dealing with fleas, as with most other insects, it is important to eliminate breeding places first and deal with living members afterward. Fleas breed copiously on soil or in dust containing animal and vegetable matter protected from wind, rain and sun, but at the same time watered somewhat. Animals and poultry should be prevented from passing beneath buildings, infested areas sprayed with creosote oil, and the breeding grounds covered with salt and thoroughly wetted down.

House infestations may be prevented by

eliminating pet animals and applying gasoline to floors after all rugs have been removed and the floors scrubbed with soap and water. Applying derris powder to pet animals, or washing them in a weak solution of saponified creosote, will destroy fleas upon them.

Fleas affect us both as disease carriers and annoyers. The awful bubonic plague was transmitted by fleas.

Roaches are a common and offensive nuisance. In temperate countries, only four or five species belong among our household pests; essentially, roaches belong to tropical countries, where their variation and abundance are among the world's wonders.

House roaches are commonly dark-brown, this being a protective coloration device. The head is bent under the body, so that the mouth points directly backward, and the eyes down.

These insects have senses so highly developed that we must show them some respect. Unless routed out of their hiding places, they are very rarely seen.

They gnaw at woolens, leather, over-stuffed furniture, the paste on oilcloths and book bindings. Besides, of course, they consume practically all kinds of animal and vegetable matter.

In addition to their cunning and stealth, the roaches have an amazing ability to guard against enemies. They display real intelligence in avoiding poisons and food doctored with insecticide. Some students believe that their highly developed senses are the inheritance of centuries, during which man fought to control them. When cornered, a roach will play dead and watch the effect on his hunter. He will not show himself to a housewife, but in restaurant kitchens, where everybody is busy, he will walk boldly.

Some simple roach poisons are sodium fluoride, borax, pyrethrum and sulphur. Fumigation is often resorted to, in ridding premises of roaches.



But extreme precautions must be taken to avoid the effect of these gases on human beings and pet animals. Carbon-disulphide gas is commonly employed.

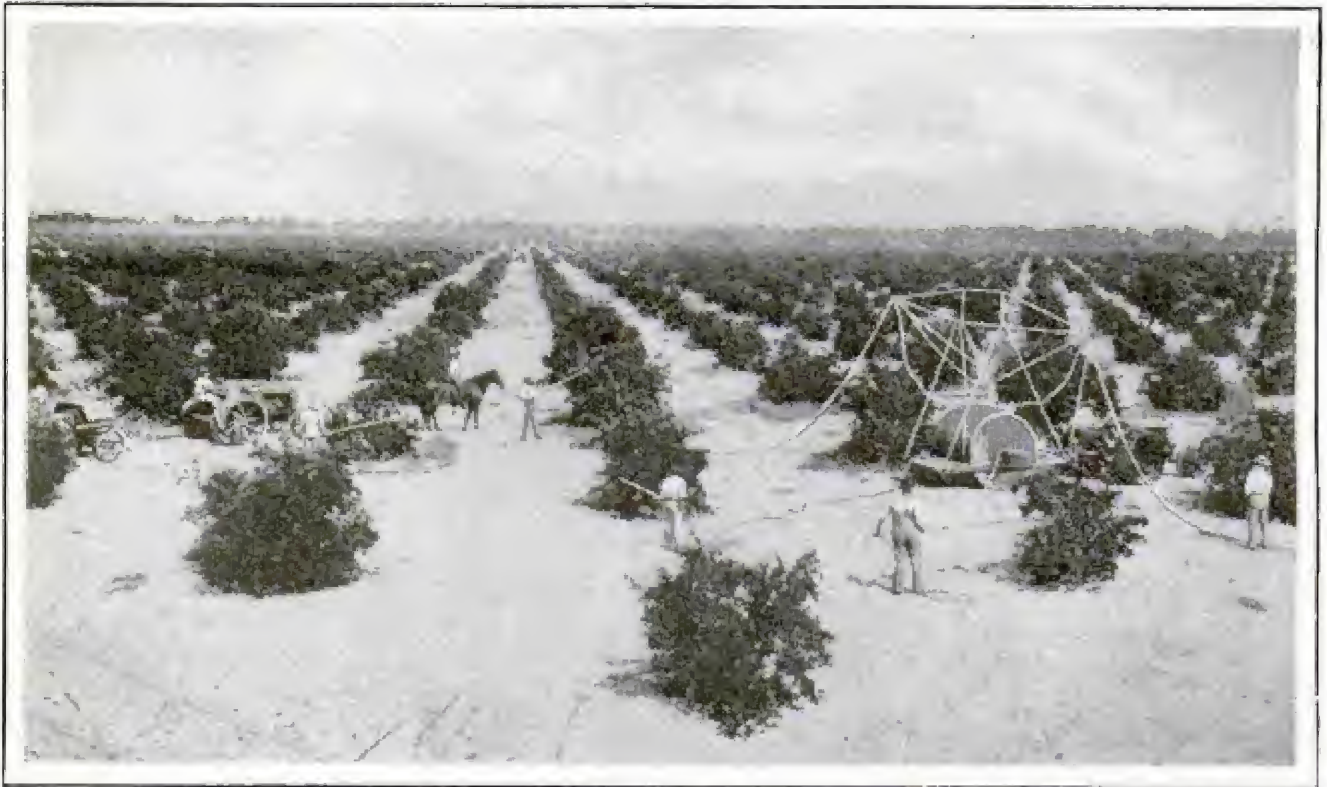
Chigger bites will spoil the best human disposition. These pests flourish during the summer months. After careful study under

a microscope, it has been determined that chiggers do not burrow under the skin. They remain attached only by their mouth parts, and engorged like ticks. After some days, they release this hold and fall off. Also, it is maintained authoritatively, that chiggers do not enter skin pores. Their attachment is purely superficial.

One method of controlling chiggers is to wear close-mesh, tight-fitting garments. High-top shoes or boots give good protection. Spiral puttees also may be worn. But on account of the heat and discomfort of leg apparel, chemical means have been devised for warring on chiggers. Flower of sulphur dusted over the clothing makes a deterrent. After application, the powder should be rubbed down. A talcum-powder shaker aids in distributing the sulphur evenly.



Field Cage for Inclosing Infected Trees; Dragon Fly Eating Prey, and Small Sprayer in Operation



Spraying Large Grapefruit Orchard with Tractor Outfit That Permits Application to Several Trees at One Time and Affords Sufficient Pressure for Reaching Difficult Places

Four common species of buffalo moths afflict households. In reality, they are not moths but fall in the classification of beetles. They are capable of subsisting on dried animal remains, but thrive especially on fine silks, wool, hair, feathers and fur. They remain secluded in dark nooks, beneath carpets and in garments.

In tight chests and trunks, protection may be had against carpet beetles by the use of crystals of naphthalene, or camphor, or fumigants such as carbon disulphide and carbon tetrachloride. Where infestation is general throughout a house or is serious in closets, it is advisable to fumigate with hydrocyanic acid gas or sulphur. But none of these fumigation methods should be performed by a person not instructed in their use.

Another control measure is to store susceptible articles in cold-storage rooms where the temperature is 50 degrees Fahrenheit, or lower.

The Japanese beetle has been successful in establishing quarters in this country. The adults attack important crops, such as the foliage and fruit of the apple, peach, and cherry trees, and grape, beans, clover, alfalfa and sweet corn.

Since the insect is a strong flyer, its spread from year to year has been steady.

Only in the summer of 1916, it was first discovered in the United States, near Riverton, N. J. The pest's few natural enemies have allowed it to multiply amazingly. It is now firmly established; on the other hand, it is being successfully curbed in the areas it has infested the longest time.

In Japan, the beetle is not regarded as a serious pest, probably because it has its native parasites. But here, this insect has found ideal resorts for its depredations. It is known to feed on at least 200 different species of plants.

The federal government enforces yearly quarantines, restricting the passage of nursery stock as well as farm produce. A scouting force operates over the eastern states and determines the spread of the insect from year to year.

Mixtures of arsenate of lead are the most promising insecticides for use against the adult beetle.

In his relentless war on insects, man seizes every device that may be applied to curbing wholesale devastation. The recent adoption of airplane equipment by agricultural interests is a case in point. In the last several years, a number of commercial firms have begun to specialize in the "air-dusting" industry.

In the south, airplanes have been used successfully in fighting the boll weevil. At army cantonments, beach resorts and industrial centers, airplanes have eradicated mosquito-breeding haunts. And in a case just reported from Canada, vast timber lands were saved from the ravages of caterpillars by a pilot of the Ontario flying service.

The Canadian department of agriculture states that, over an area of eighty square miles dusted with poisonous chemicals, it is difficult to find a single caterpillar, whereas, before the dusting, from fifty to seventy pests could be found on a two-foot twig.

TEST MACHINE FINDS DEFECTS IN FRONT END OF CAR

Locating and correcting faulty alignment in the front end of the automobile without removing the wheels or other parts is made possible with a tester now available for garages. Front-wheel alignment, turning-range alignment, bent spindles or axles, wheel wobble, axle tilt, wheel camber, and kingpin or spindle-bolt pitch, all are shown by instruments on the machine, which also reveals when the defect has been corrected. The tester, on a rack, includes axle press, hydraulic jacks, camber and caster tool, axle level, wheel-alignment machine and a longitudinal sight and target. Locating front-end troubles takes only a few minutes with the tester, and they may be corrected on the



This Apparatus Automatically Indicates Faulty Alignment of the Auto's Front End

rack without heating the axle or removing the wheels. The equipment occupies small space and is portable.



© Henry Miller

Rare Specimen of the Stone Fish Which Closely Resembles Coral among Which It Lives

RARE "STONE" FISH IS FOUND HIDING IN CORAL

Two scientists visiting the Great Barrier Reef, Queensland, recently captured a specimen of the rare and poisonous stone fish whose camouflage so closely resembles the coral among which it lives that it often is mistaken for an inanimate stone. It has poisonous spines, a scratch from which causes intense pain and, sometimes, death. Its skull-like head is distorted into a series of bumps and hollows of lemon-yellow, pock-marked with gray, while the spines also are yellowish. Body and fins are brown with yellow or red warts. The specimen died within a few hours and was presented to the Australian museum.

TRAIN IS COOLED BY ICED AIR

Ice-cooled railroad passenger cars have been tested successfully in France. An electric fan in the passenger coach blows air through a chamber filled with about half a ton of ice, the draft being controlled at will, to filter and cool the air. During tests, the temperature outside registered from ninety-three to ninety-five degrees, but the passengers were cool and comfortable.



Drawing Showing How an Airplane Trailed a Carrier Pigeon to Its Home to Capture the Ingenious Blackmailer Employing the Bird

AIRPLANE TRAPS BLACKMAILER BY TRAILING PIGEON

German police have successfully employed an airplane to foil a blackmail plot, although the criminal was ingenious enough to use a carrier pigeon in his operations. A Hamburg resident received a package containing the pigeon and a letter, instructing him to attach notes amounting to 5,000 marks to its neck and release it. Two pilots in an airplane trailed the pigeon and photographed from the air the dove cote in a suburb on which it alighted. Confronted with this evidence, the criminal confessed.

MUSIC TRANSFORMED TO LIGHT AS AID TO STUDENTS

To aid music students in perfecting their technique, musical sounds have been transformed into ribbons of light that write their characteristics on a screen to give a moving picture of the sounds.

Refer to A. A. Hill Instrument Co. 1100 West Washington St. Chicago, Ill.

If low, pure sounds are made, the strip of light ripples smoothly, but discordant tones cause it to move irregularly and writhe like a serpent. For all graduations of harmony there is a distinct wave, different for each sound, even down to discrepancies in tone too fine for the ear to distinguish. The instrument used is a development of the "Osiso," used for some time to photograph voice and music characteristics. The development consists in substituting a moving picture for a still. In it is a mirror, vibrating under control of an electrical current from a microphone that picks up the sounds to be pictured. The mirror reflects a beam of light through revolving mirrors, and by this means music students are given a pattern of a perfect sound and attempt to reproduce it in the light. The instrument is so delicate that it even showed a record when a pianist struck his fingernails on the keys in playing, and is to be used extensively to calibrate the harmony of musical instruments.

RUBBER BOOT FOR SHIFT LEVER PROTECTS CLOTHING

Affording protection from grease and oil around the shift lever of the automobile, which frequently soils the clothing of the motorist, a rubber boot for this part of the car is now obtainable. The boot slips down over the base of the gear shift, without interfering with its action.



ARE YOU A GOOD DRIVER? AVOID THESE FAULTS

One out of every 120 or so people in the United States will be involved in an automobile accident next year, judging from 1928 accident reports tabulated by Dr. Louis I. Dublin, of the Metropolitan Life Insurance company. In other words, automobile-accident deaths and injuries are around a million a year. The United States, which leads the world in the percentage of fatal accidents, with seventy-eight per 100,000 population, had 27,500 automobile deaths in 1928, and 950,000 non-fatal injury cases. Widening roads to handle the increased auto traffic has failed, recent surveys show, to materially reduce accident totals because of the careless habits developed by drivers on the wider high-speed pavements. Analysis of driving faults on the wider well-marked highways, discloses the leading ones are straddling two lanes, which not only is dangerous but reduces the capacity of the wide road to that of a narrower one; cutting across traffic from one lane to another; forcing approaching cars into the ditch by straddling lanes; parking on the pavement to make repairs and change tires, and driving at low speed in center lanes, forcing faster cars to pass on the right instead of the left.

PULLING POWER OF HORSES IS MAINLY DUE TO WEIGHT

Large horses are better than small ones for pulling heavy loads, tests at the Illinois agricultural experiment station have disclosed, although many horse owners have insisted that a "good little team" will out-pull a big one. Trials were made with 144 different teams, and accurate measurements of their performance taken with a dynamometer. It was also found that a good disposition was an important factor in the animals' success as pullers, and skillful driving was shown to be as necessary as good horses. Unshod animals were unable to hold their own against well-shod teams. It was also proved that horses must be in good flesh to do their best. One team's performance was the equivalent of starting a load of 38,960 pounds for fifteen or twenty consecutive times on a granite-block pavement.



Here Are Posed Pictures Showing Five of the Commonest Causes of Automobile Accidents

Canada's Flying

By J. EARLE MILLER

A FEW weeks ago an airplane circled a time or two over a little unmapped lake in the wilds of far northern Saskatchewan, the roar of its motor died away to a soft purr as the pilot "cut the gun" and it swooped down to come to rest, straddling high above the water on the tall, stilt-like legs that supported the cabin fuselage above the seaplane pontoons.

The pilot cracked the throttle a trifle, the song of the big "Wasp" engine picked up an octave or two, and the Fokker taxied ashore, until the pontoons were wedged for a quarter of their length on the sandy beach. Out of the cabin stepped a mining engineer whose curiosity had brought him out from Winnipeg to learn why Indians had given the little lake a name that means, in English, rottenstone. The little lake was



Eskimo Girl with a Pair of Malamute Pups Too Small for Sled Training, and a Fairchild Plane of the Hudson Strait Patrol Being Towed from the Hangar by a Tractor

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Sheppard St
Toronto
Can. Can.

Gold Rush



Fairchild, Belonging to Northern Aerial Minerals Exploration, on the Banks of the Laird during a Prospecting Trip into the Far Northwest and across the Barren Lands

so unimportant it doesn't appear even on mining maps of the district.

As the engineer stepped ashore, directly in front of him, on the north bank of the lake, rose a low mound, shaped like a domed anthill, thirty-five feet high and 165 feet in diameter. Its almost bare sides were dull green and gray, the "green-stone" of the Canadian prospector, the only rock formation in which important ore finds have been made, the pre-Cambrian shield, the oldest stone in the north country, so old that its weathered seams and strata have chipped and cracked and broken, and let the gold and silver, platinum, copper, nickel and zinc, and the lead extrusions force their way through. And that was the answer to the enigma of the lake's name, a vast mound of aged and rotted stone.

A few hours' work collected a bagful of samples, so rich that the naked eye could almost estimate their value. The entire mound was one vast heap of wealth, piled up in plain sight, not under the ground like most mines, but set out where anyone passing by for many centuries might have seen it. Those samples as-

sayed \$40 to the ton, forty dollars of gold, copper, nickel, platinum and zinc. With the exception of cobalt, lead and silver, everyone of the important metallic minerals of Canada was represented.

In this one story is summarized all the main facts of a revolution in mining, a revolution that has, in three years, put Canada to the forefront as one of the greatest mining areas in the world; a revolution that brought a new form of transportation to prospecting, combined flying and gold hunting and moved the clock of time forward at least fifty years.

Two years ago one of the oldest forms of transportation, the canoe, reigned supreme in all the vast stretch of country from the north line of the Canadian National to the Arctic ocean in summer, and the dog team did the same in winter. To-day, except for short local journeys, the dog team and the birchbark or canvas canoe are almost as rare as horses on Fifth avenue, New York, Michigan avenue, Chicago, or Market street, San Francisco.

The story of the discovery of Rottenstone lake is romantic and unusual only because it came from a "hunch," from the



curiosity of a man in a distant city office, who suspected the Indians had some good reason for giving the lake the name they did. The rest of the story, the use of an airplane to do in less than one day what would have taken a party of guides and prospectors an entire summer to accomplish by canoe, is just one of dozens of similar stories. By air you can hop off after breakfast, fly two or three hundred miles out from civilization, knock off a few samples of greenstone with a geologist's hammer, and fly back home in time to have them assayed before supper. Hundreds of men—prospectors, geologists, mining engineers and mining-syndicate scouts—are doing this, and, in fact, are doing it practically every day.

At the time this is being written, the annual report on mineral production in the Dominion



Top, Using an Eiderdown Sleeping Bag to Shield the Motor While Heating the Oil; Center, Cleaning Snow from a Fokker's Wing, and, Bottom, Changing Wheels to Skis

of Canada in 1928 was not completed, but a preliminary report, published by the Dominion bureau of statistics, shows \$273,446,864 was extracted from the ground last year, and the surface has hardly been scratched.

The vast pre-Cambrian shield stretches over a large part of the north country, and it is in this oldest of rocks that the precious minerals are found. Canada contains ninety per cent of all the

pre-Cambrian shield in the entire world. The other ten per cent stretches south of the border into Michigan and Minnesota. From that ten per cent, with intensive prospecting, the United



The Evolution of Land and Water Transportation; Top, York Boats of the Hudson's Bay Company under Sail on the Bay, and, Center, Bullock Carts Used for Transport on the Portages between Lakes and Rivers; Although Canada Is Studded with Thousands of Rivers and Lakes, the Connecting Portages and Those around Rapids and Falls Have Always Proved a Difficult Problem



In Winter a Tractor with a String of Cars on Sleds Can Move Fifty Tons of Freight over the Snow and Maintain a Regular Schedule Day and Night



Planting the "Discovery Post" on a Mining Claim in Northern Ontario; the Next Step Is a Dash to the Mining Recorder's Office Somewhere along the Railroad to Record the Find

States has developed the marvelously rich iron mines of the Messaba range, and the fabulously wealthy copper mines of the Calumet district, in upper Michigan. If, say Canadian geologists, mining engineers and prospectors of the United States, with only ten per cent of the pre-Cambrian rock, can take out the wealth of Messaba and Calumet, what can't Canada do with the other ninety per cent?

Kipling once wrote of aviation that the world had reached the opening verse of the opening page of the chapter of endless possibilities, or words to that effect. That is the status of Canada today as a mineral producer. All the four billion dollars' worth of minerals, taken out of her ground in the past half century or more, represent only samples picked here and there from a mineralized land so vast that a great part of it has never been mapped, and, until the airplane came, had never even been seen by white men's eyes.

In 1915 a party of half a dozen old-time prospectors, led by Jack Hammell, paddled out from the end of steel at The Pas to see what they could find to the northwest. With huge thirty-foot birch-

barks, capable of carrying four tons of men and supplies, and a crew of Indian helpers to paddle and portage the supplies from lake to lake, they swung up the Saskatchewan almost before the last ice floes had cleared the river, turned north at the old Hudson's Bay post of Cumberland House, spread big square sails and skimmed along before the wind through the chain of lakes to what is now Sturgeon Landing, turned west again, upstream and over portages around rapids, until they reached Amisk lake, crossed it and portaged again into Athapapuskow lake, and on its north shore made camp. There, something like a hundred miles from The Pas as a bird flies, they staked claims that it has taken just fourteen years to develop. They had to fight and win a provincial election to interest the Manitoba government, for the claims were hardly a stone's throw east of the Manitoba-Saskatchewan border. Then, turning the birchbarks and Indian canoemen again, they had to transport an entire provincial legislature through the miles of lakes and rivers and show them the spot before they could convince the law-

makers that Manitoba really had a future as a mining center. And finally they got a railroad in, a branch line leading off from the Hudson Bay road north of The Pas, and the branch was opened for service in the last week of July of this year, though equipment for the mill had already been transported in before the ballast had been completed. Fourteen years of work, and these claims, now in the hands of the Whitney syndicate of New York, are do-

Flyer in Winter Garb Ready to Take Off on the Hudson Straits Ice Patrol in the Far North



Typical Bush Country: from the Air It Looks Like Rolling Meadows. But Actually It Is Almost Impenetrable Jungle of Jack Pine, Tamarack and Birch; Below, the Modern Surveyor's Instrument Is a Camera

ing development work that will represent an investment of \$50,000,000 before much ore is taken from the ground.

In the winter of 1925-26, Lorne Howey and his brother staked their discovery claim at Red lake and started the wildest gold rush the north country has seen since Klondike days. The Red lake district lies a hundred miles or so, as a bird flies, from civilization, as represented by the little trading post, flag-stop town of Hudson, on the northern line of the Canadian National, some 240 miles east of Winnipeg, and about the same distance north of Duluth, Minn.

Leaving his brother to watch the claim, Howey trekked out to the railroad, and



got word through to his old friend, Jack Hammell. With the fastest dog team they could procure, they started, and in twelve days of grueling going reached Red lake and, after crosscutting and trenching through the snow to check the extent of the surface showing of ore, closed the deal whereby Hammell took over the development of the claim.

News spreads fast even in the bush, and by that time prospectors were pouring in by the hundreds and the shores of Red lake were staked as far as the eye could see. They came by dog team and on snowshoes, carrying food packs on their backs, and in their wake came the first airplane. In that plane Hammell flew out to civilization in one hour over the route that had taken the fastest dog team twelve days to cover. From that day the future of flying in the north was assured.

Gold has a lure for men, and, even though it is far from being the most useful mineral resource, a gold discovery invariably brings a stampede, where the

more prosaic minerals may pass almost unnoticed. Because of that eager search for it, it is only natural, perhaps, that the value of the gold output should exceed that of any other metallic mineral—

\$39,091,472 last year out of a total value of \$131,904,603 for all the metallics, and that list ranged from arsenic, bismuth, cadmium and cobalt, down through copper, gold, iron, lead, nickel, palladium and rhodium, to platinum, silver and zinc.

The whole mining industry of Canada, from gold to grindstones, and actinolite to volcanic dust, which also has its place in commerce, represents an investment of \$700,000,000 and gives employment to 85,000



What They Wear in the Bush during Fly Season; Indian Comic Mask from One of the Canadian Tribes; Jack Hammell, Left, and "Sandy" McIntyre

men. With \$50,000,000 being spent on one modern mining plant at Flin Flon, and a total mining investment of only \$700,000,000 in all Canada, some idea is gained of the relatively small extent to which the surface has been scratched.

The lack of transportation, which has held lode-mining development to a narrow fringe along the Great Lakes and St. Lawrence, and to a fairly small portion of British Columbia, is rapidly becoming a thing of the past, and with the development of lode mines, the invested capital will grow by leaps and bounds.

The Klondike and the early mines in northern British Columbia and the adjacent Peace river country were mainly placer developments, in which free gold is found scattered through alluvial gravel. Placer gold can be extracted with an investment of a few dollars in a pick and shovel and pan; it can be washed out faster by being sluiced through wooden boxes with rows of riffles to trap the heavy



Photos Courtesy Canadian National and Canadian Pacific Railways, N. A. M. E., and Canadian Government Bureaus




Prospectors Placing a Summer Cache in a Tree to Protect It from Bears, and, Left, Sinking a Winter Shaft

metal; whole hillsides can be washed away and into the sluice boxes with a giant nozzle, if sufficient water power is available; or a gold dredge may be used, but, regardless of the method, the invest-

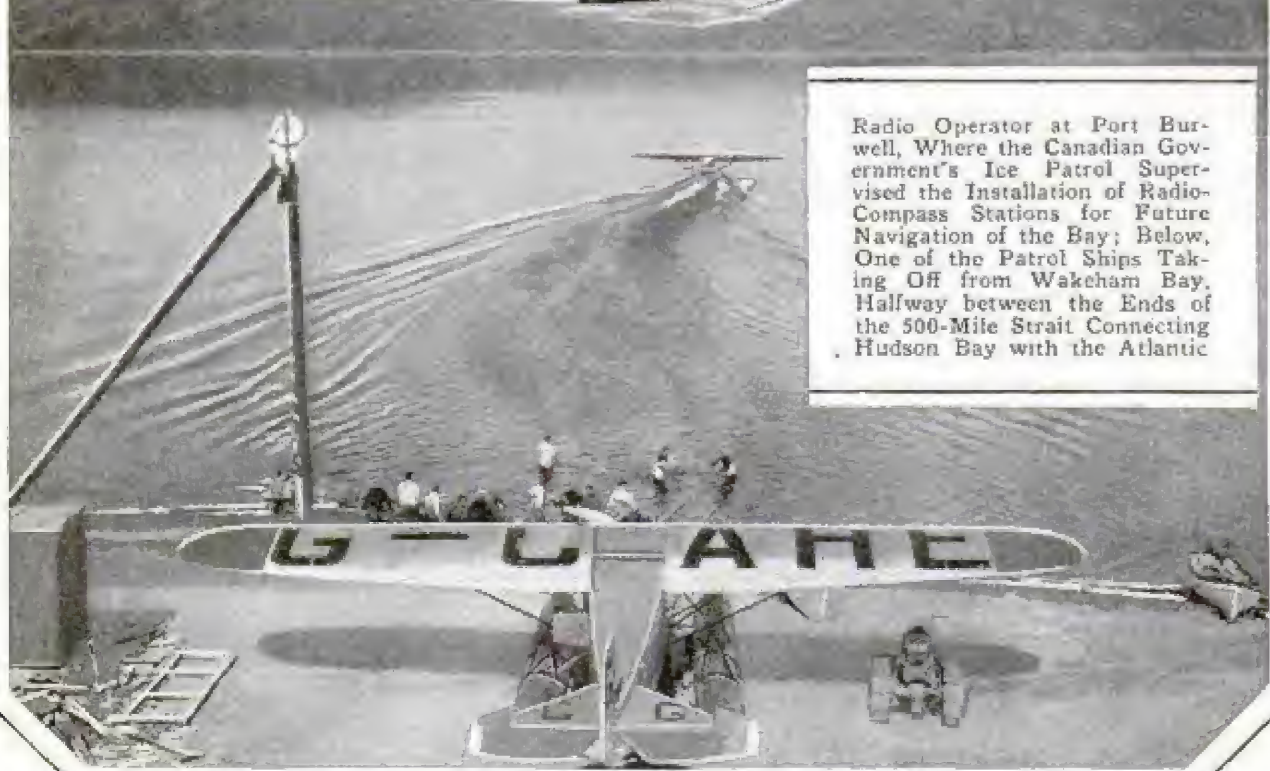


Examining Rock Specimens from a Trench Cut across the Face of a Silver Vein, at Lorrain, Northern Ontario

ment is fairly small. Compared with that, the extraction of the precious metal from hard rock requires an elaborate underground mine, with compressed-air drills, dynamite and a railway; an expensive mill to crush the rock to a fine powder, and



Summer at the Entrance to Hudson Strait, with a Plane of the Ice Patrol Coming In to Port Burwell; the Ice Does Not Leave the Cape Chidley Neighborhood until Early August, the Patrol Found



A black and white photograph of a biplane with floats on the water. In the foreground, there is a large antenna mast. The plane is moving across the water, leaving a wake. Several people are visible on the plane.

Radio Operator at Port Burwell, Where the Canadian Government's Ice Patrol Supervised the Installation of Radio-Compass Stations for Future Navigation of the Bay; Below, One of the Patrol Ships Taking Off from Wakeham Bay, Halfway between the Ends of the 500-Mile Strait Connecting Hudson Bay with the Atlantic

finally an elaborate cyanide plant to separate the metal from the rock. All that entails an immense investment, and the bulk of the machinery makes some form of heavy transportation imperative.

Consider the situation of Rottenstone lake. A million-dollar mound of \$40-a-ton ore, heaped up on the lake shore, is a fine sight to contemplate, but if there is nothing more there, that mound may remain for many years to come, for in itself it is not sufficient to warrant building transportation in to the site, and, at present, packing even forty-dollar ore all the way to the railroad and then shipping it to a smelter, probably Trail, B. C., would not be a paying venture.

But there are two hopeful things about Rottenstone. For one, the mother vein may be found, and prospectors and geologists are there as this is being written, trying to trace it down. The hunt is complicated by curiously disarranged geological conditions. The mound rises almost from the shore of the lake. Behind it is a high ridge of granite, which precludes the possibility of the vein dipping in that direction. On the opposite side of the mound it might dip out under the lake, but all the prospecting done to date seems to indicate an incline which angles away to the right in an effort to pass around the granite ridge.

The other hopeful factor is Lac La Ronge, sixty miles or so to the south. A wide vein of low-grade copper ore, three miles long and assaying \$7 to the ton, has been discovered at this lake. Its extent indicates it may warrant building a railroad from the end of steel at Paddockwood, just north of Prince Albert, for \$7 copper can be worked to advantage, if there is enough of it. With a railroad built as far as Lac La Ronge, a vein may yet be uncovered at Rottenstone to warrant the additional sixty miles of tracks.

These are some of the problems the prospector faces when he takes to the bush to hunt a mining claim.

(To Be Continued Next Month)



Folding Auto Table for the Tourist, Which Attaches to the Back of the Front Seat and Is without Legs

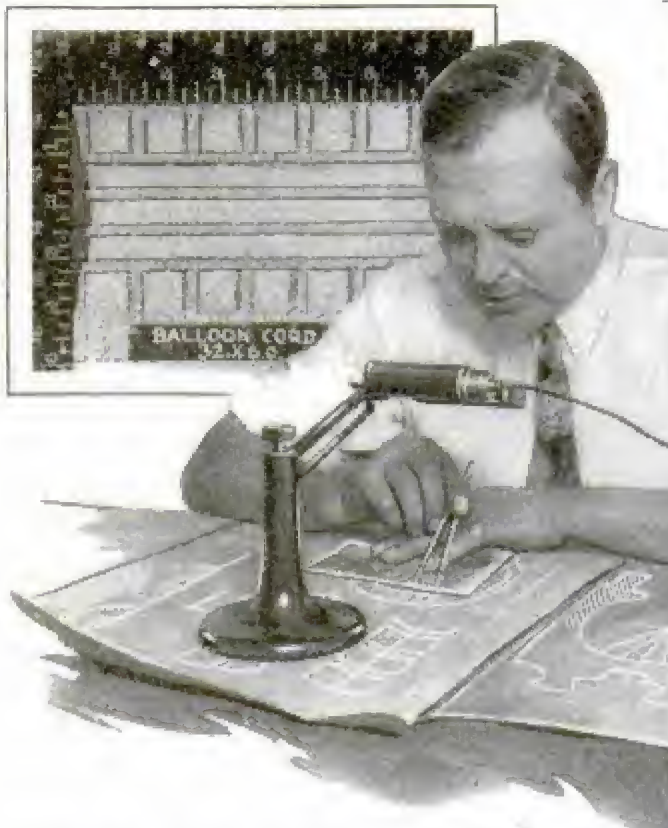
COLLAPSIBLE TABLE FOR AUTO ATTACHES TO FRONT SEAT

Added convenience for the tourist or camper is afforded by a folding auto table which attaches to the robe rail, robe cord or to special loops that fasten to the back of the front seat. The table, sixteen by twenty-eight inches in size, will carry a portable typewriter and is suitable for lunches, or for writing in the car. There are no legs, and, when collapsed, it folds into a compact bundle to be inserted into a case and is slipped under the seat.

AIRWAY LIGHTS IN U. S. COVER TEN THOUSAND MILES 1457

Airway lights in the United States now cover 10,180 miles and additional 2,085 miles are being equipped with beacons. There are 263 intermediate landing fields, 1,406 airway beacons, 164 weather-reporting stations, twenty-seven communication stations and seven radio range beacons on the country's airways.

Clarence M. ...
Director, Bureau of Aeronautics



Bandit Cars Being Identified by Comparing "Finger-printed" Tire Treads with Tire Specifications

FINGERPRINT AUTO-TIRE TREAD TO CATCH CAR THIEVES

Identifying bandit automobiles by their "fingerprints," the marks left by their tires, has been undertaken by the Los Angeles sheriff's office with successful results. There are about 450 patterns of tires in existence, and methods of photographing tire treads for identification purposes heretofore had to be worked out

with the aid of a mathematician who had to figure the focal length of the lens, the height at which the camera was set, and other data. Los Angeles authorities place a try-square on the imprint of the tread, and the picture of the imprint and the square provide a means of showing the tire size, if other information is available for comparison. Such pictures reveal the size and make of the tire and the diameter of the wheel, and when compared with specifications from the tire manufac-



turers, it is often possible to tell the kind of car, the load it carried, the approximate mileage, and whether it has been used mostly for country or city driving.

"ELECTRIC SHADOW" OF PLANE IS USED FOR RADIO

"We are now passing over Gunpowder river; altitude 2,400 feet; speed, 100 miles per hour." This was just a plane radio message like thousands floating down from the air to the earth every day. Yet it opened a new epoch in radio communication between a plane flying and the ground. It marked the first utilization of the "electric shadow" of a plane and ended the costly practice of shielding and bonding airplane motors—making them electrical units—to prevent interference with ground communication from the air. C. Francis Jenkins, noted inventor, is dis-

coverer of the electric shadow, a fan-shaped non-interference field at the rear of a plane with reference to its motor's electrical high-tension wires. As explained by Mr. Jenkins: "We have discovered that an electrical shadow follows an airplane, opening out fan-wise from its body to the rear, in which there is no interference from the high-tension wires of the motor. In this shadow we tow our antenna. Here perfect reception and transmission are possible. Bonding and shielding, therefore, may be done away with." In proof of his theory, Mr. Jenkins made two flights in an unbonded and unshielded plane, and no difficulty in transmission or reception was encoun-

The following is a list of the cars used in the investigation.

1579 Connecticut Ave Washington D.C.

tered at any time. The antenna for the test was made fast to the top of the airplane rudder. It was reeled from the fuselage through a guide attached to the rudder. A wind cone "canvas arm sock" carried it back 125 feet. The non-interference field has been determined to extend 1,500 feet behind a plane. The shielding and bonding of an airplane motor costs over \$1,000. That cost is now eliminated, and also the danger of electric leaks.

TOOL MARKS BLIND HOLES FOR SCREWS 3561

Elaborate layout and uncertain guesswork in locating blind screw holes are eliminated by a simple combination called a thread-button set. Each "button" consists of a hardened screw, similar to a headless setscrew, with a hexagon-shaped projection on one end. The end of the hexagon is shaped into a center-punch point. In use, the buttons are screwed into the part containing the blind holes, with the marking points out. This part is then laid in position over the piece in which are to be drilled the holes for the bodies of the screws and tapped with a hammer. The points of the buttons mark the centers of the body holes. The set of buttons is held, when not in use, in a handle, which also forms the socket wrench for the purpose of placing them.



© P. & A.

This Exact Model of a Big Ocean Liner Is the Pride of a Crew of Boys in Berlin, Who Man the Trim-Looking Craft

BOY-SIZE OCEAN-LINER MODEL IS EXACT MINIATURE

Modeled along the exact lines of a big ocean liner, a miniature giant of the seas has been built in Berlin. The little ship is manned by a crew of boys.

BLUE RATS ARE LATEST 3588

If you see a blue rat, don't be alarmed. Dr. Elmer Roberts, of the University of Illinois, reports the appearance of a blue strain of rats among those kept at the laboratories for experiments. Inasmuch as this color has never before been observed in several generations of the rats, it is believed to be of evolutionary character.

FLYING SKYROCKET BLAZES WAY ACROSS THE SKY



An airplane has been designed to spray fireworks across the night sky. Its operation was explained at the Stewart Aircraft company's hangar by William A. Butters and his assistant, Dale F. Dryer. The plane carries twelve "falls" and three magnesium flares on each side, in special racks that have been attached to the lower wing. Falls are like Roman candles without the balls, Pilot Butters explained, and they are set off by means of electrical contact through wiring from a six-volt storage battery. There are eight switches in all, four for each side of the plane, and they are installed where Dryer, who sits in the middle seat of the three-place ship and faces Butters in the rear cockpit, can easily reach them to set off the fireworks. Butters keeps his eyes from the brilliant display or he would be temporarily blinded and handicapped in maneuvering the plane, which is put through loops, spins and other stunts. From his position, Dryer is able to tell at once when a piece has been burned up. Pressing another switch sends the current that sets off the next flare or fall. During the exhibition, a wind-driven siren, which can be shut off or turned on at will, attracts the attention of all those of the crowd who at first are not aware of the presence of the spectacular "comet on wings."

Artist's Drawing of the Fireworks Plane in Flight, and Insets Giving Close Views of the Rack and the Falls Being Inserted; Man Facing the Pilot Fires the Flares by Pressing Electric Buttons



The Towers at Each Side of the Royal Gorge, on Which Will Rest the Highest Suspension Bridge in the World; It Will Be 1,052 Feet above the Arkansas River

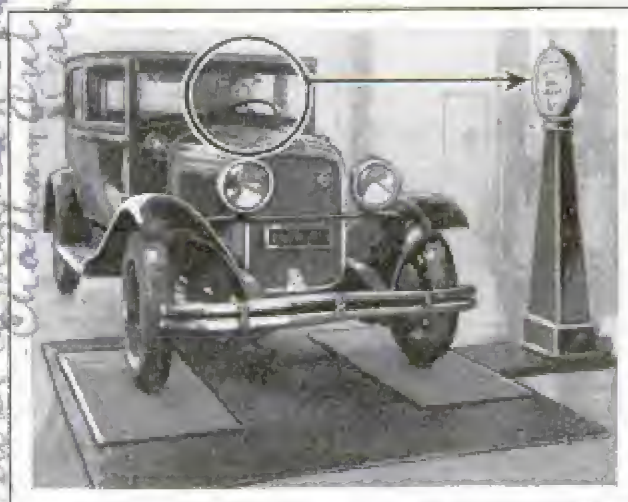
HIGHEST BRIDGE IN THE WORLD TO SPAN ROYAL GORGE

With an altitude of 1,052 feet, the bridge now being constructed over the top of the Royal Gorge, near Canon City, Colo., will be the highest suspension bridge in the world, reaching more than twice the height of its nearest rival, which is in southern France. The length of the main span of the Grand Canon bridge will be 880 feet, and the total length 1,260 feet. From its eighteen-foot roadway may be seen the waters of the Arkansas river far below, and tracks of one of the western railroads. Steel towers on each side of the gorge rise 150 feet, and two cables, each nine inches in diameter, will have a strength of 120,000 pounds per square inch. Some idea of its height can be

gained by the fact that two Washington monuments could be placed end on end under the structure, yet not reach the bridge.

ALINEMENT OF AUTO'S WHEELS SHOWN ON DIAL

Checking faulty alinement of automobile wheels is made easy with an indicator being installed in service stations. The customer is enabled to check his own wheels by driving onto a platform resembling a scale, and glancing at a dial, the hand of which indicates the number of feet side slip due to wheels being in or out. Attention is called to excessive mis-alinement by a bell. The front wheels are tested first, and then the rear wheels are run onto the platform.

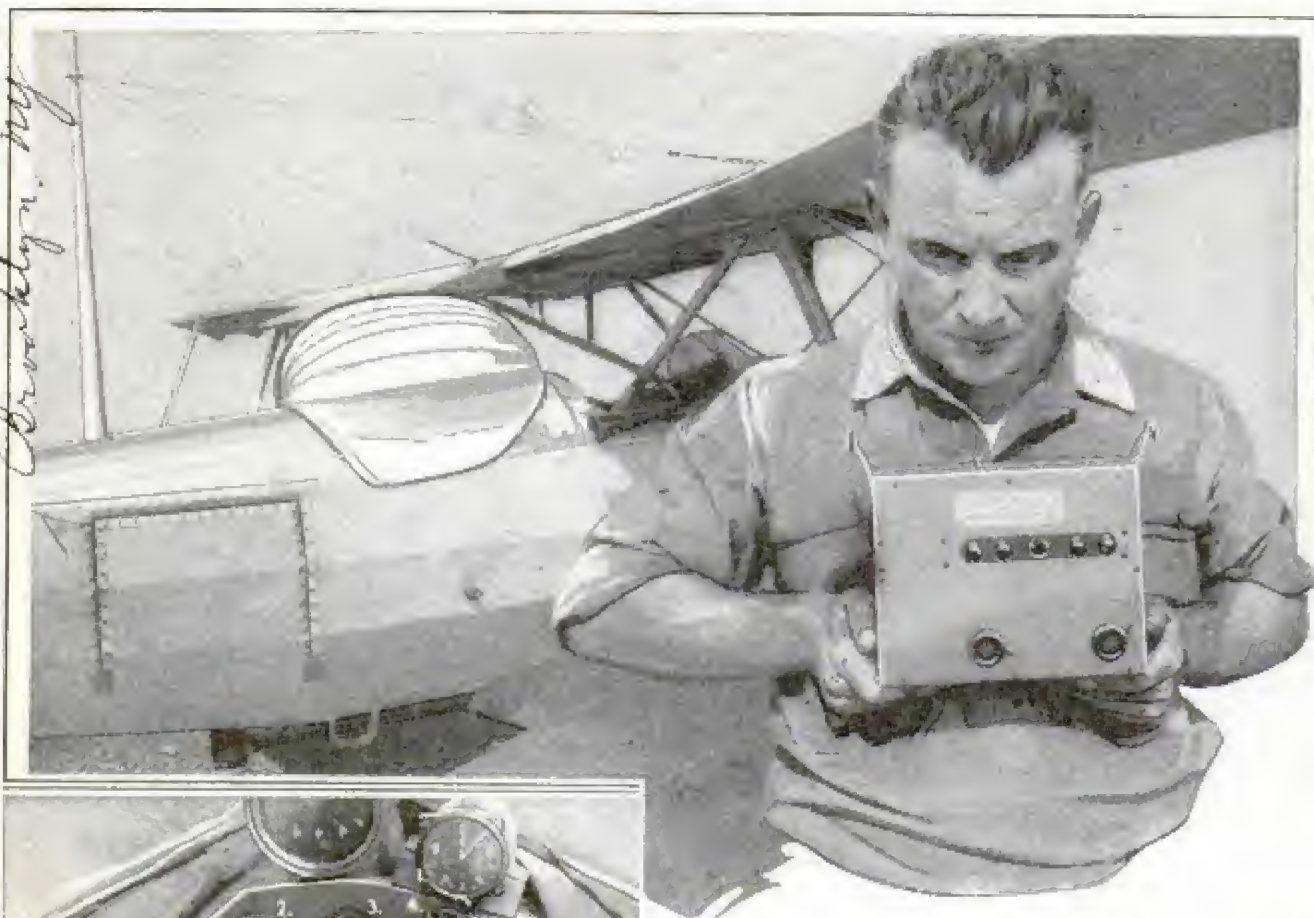


Faulty Alinement of Auto Wheels Is Shown by Driving on the Platform and Reading the Dial

Weaver Mfg. Co.

Chicago-Quel & Logan's 2050-A & 692 St.

"BLIND" PILOT PAVES WAY TO CONQUEST OF FOG



The Covered Cockpit in Which a Pilot Made a "Blind" Flight, and Instruments Which Guided Him

tenant Doolittle was able to perform the feat comprised only three beyond those used in everyday flying. These were a barometric height indicator registering in ten-foot units instead of 100 feet, a gyroscopic direction indicator and a special artificial horizon which at all times shows the plane's position with relation to the ground. The two latter instruments enabled the blind pilot to make a perfect turn, a landing, or any maneuver normally accomplished in daylight. A radio receiver of the vibrating-reed type kept the pilot on a definite course, the right or left reed vibrating excessively as he deviated. The radio was capable of two-way communication, and the pilot sent messages to the radio-beacon station on the ground during his flight. While still in the experimental stage, it is hoped that the instruments will form the basis for making flights of the future independent of weather or visibility conditions.

☛ There are deposits of coal in the antarctic regions.

Foreshadowing the time when fog, man's greatest enemy in the air, will be defeated, Lieut. James H. Doolittle, army flyer, recently took off, flew over a fifteen-mile course, and landed a plane without once seeing outside the cockpit. The "blind" flight, sponsored by the Daniel Guggenheim Fund for the Promotion of Aeronautics, marked the first instance in which a pilot negotiated a complete flight from take-off to landing by relying on nothing but the instrument board in front of him. An emergency pilot was ready to take over the dual controls at any time the flyer in the shrouded cabin encountered difficulties, but his services were not required. The instruments by which Lieut.

Doolittle's flight was a complete success. The instruments by which he was guided were of the vibrating-reed type. The radio was capable of two-way communication. The pilot sent messages to the radio-beacon station on the ground during his flight. While still in the experimental stage, it is hoped that the instruments will form the basis for making flights of the future independent of weather or visibility conditions.

HOLE IS BORED TO CANADA FOR MOTOR CARS

Boring under the Detroit river to link Detroit and Windsor, Ont., by a tunnel which will accommodate 2,000 automobiles an hour is being accomplished without disturbing traffic in the streets or jeopardizing adjacent buildings. An army of workmen is pushing its way through the ground behind the protection of a gigantic steel shield. The shield is a circular steel face pressing against the clay that is to be dug away. Behind it the men, known as "sandhogs," dig through slots in the shield until enough earth has been removed to allow hydraulic jacks to push it forward eight inches. To protect the workers against cave-ins, the inside of the tube is steel-lined as it moves forward, this being done by a circular arm which swings inside the shield, carrying a steel band that is clamped in place and welded much like a barrel hoop. The underwater section of the tunnel is formed by steel tubes, weighing 4,000 tons each, sunk and concreted together.

FILLING STATION FOR PLANES AT LONDON AERODROME

British aviators using the Hanworth aerodrome, near London, may fill up their gasoline tanks in the same manner as the motorist. The field is equipped with filling stations, a line on an extension running from the pump by an overhead support to the plane. The airport caters to private owners and gives them instruction in flying their ships.



A British Airport Equipped with Stations Where the Aviator May Fill His Tanks Just as the Motorist Does



This Cabinet Contains Apparatus for Imitating a Score of Sounds in Radio Broadcasting

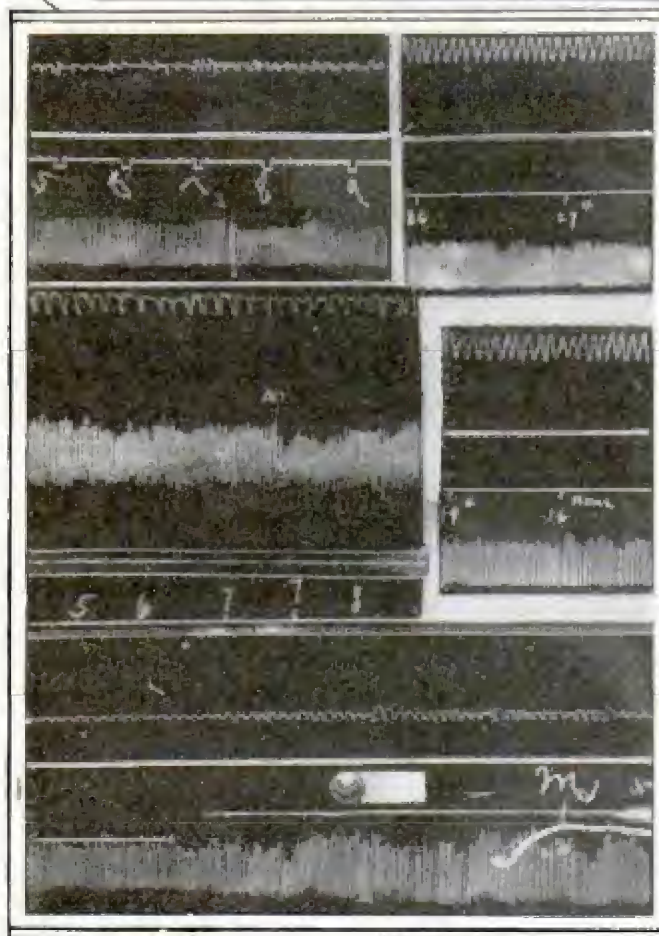
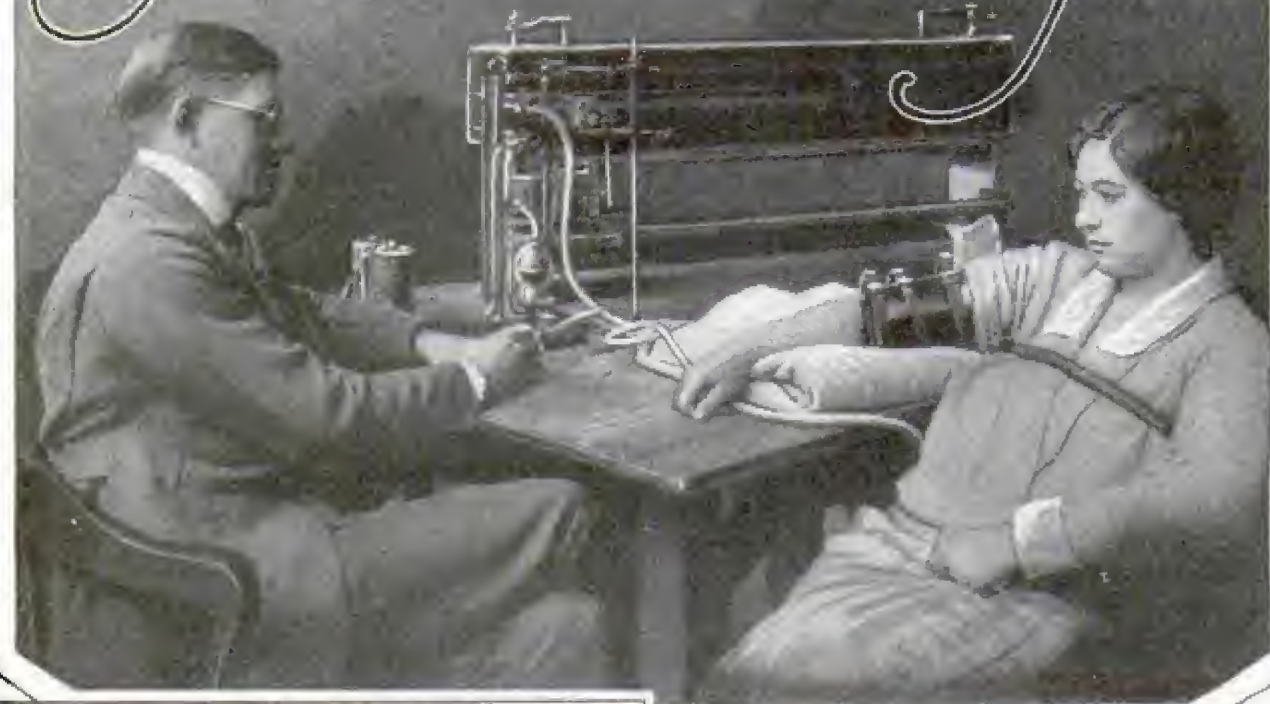
QUEER RADIO SOUND EFFECTS ARE MADE TO ORDER

Noise makers and amplifiers capable of producing twenty different sound effects, frequently used in radio broadcasting are contained in a single cabinet employed in some radio studios. The apparatus resembles an ordinary radio cabinet, except that, along one side, are push buttons, cords, cranks and levers. Inside are dry cells operating electric bells, a hollow cylinder filled with sand, an electric fan, a large horn and several other sound-producing instruments. Among the effects are bells of every type from the ringing of the telephone to the gong at the prize fight, a vast miscellany of whistles, from fog horns to locomotives, the roar of a locomotive, the whir of an aeroplane, and the sounds made by automobiles and galloping horses. Dog barks, the roar of the lion and the sounds of falling water and beating surf also are imitated.

☐ The average life of a passenger automobile is seven years.

3190

The Detective of the



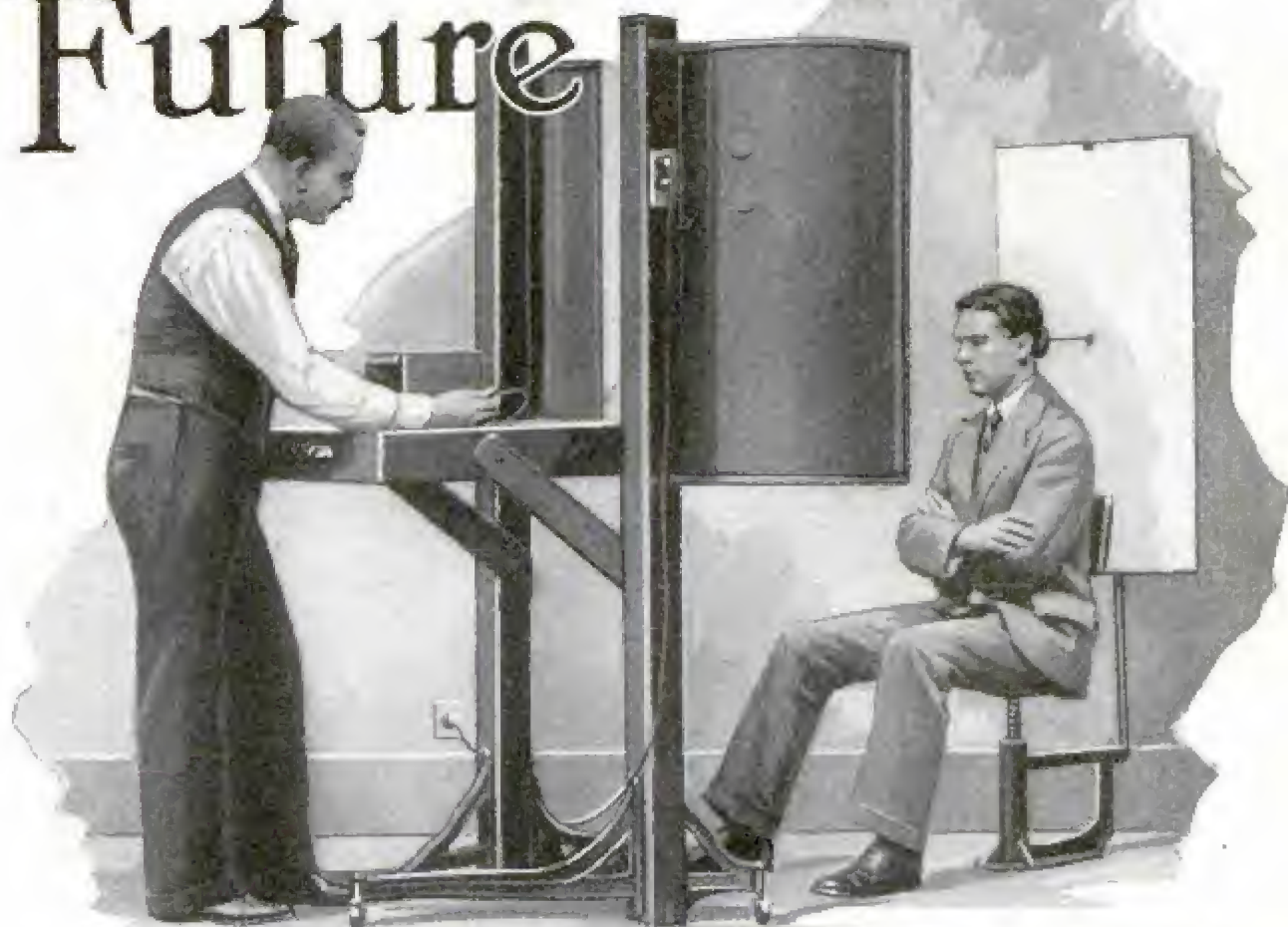
Dr. John A. Larsen Using the "Lie Detector," and Reproduction of Some of the Instrument's Records of a Subject's Emotional Reactions

By H. H. DUNN
4351 Escondido St. San Diego, Calif.
"CIVILIZATION of the future must look to science for its protection from crime."

August Vollmer speaking, at his desk in Berkeley, Calif., where he has created and established what is said to be the only "scientific police force" in the world, with such success that crime has been prevented, acts against life and property checked, and young boys and girls of wayward bent turned back to lives of honesty. This fall, Chief Vollmer became head of the department of police science in the first college of criminology in the world, just established by the University of Chicago. Six months of each year he will direct this department and the other half year he will be found in headquarters at Berkeley.

"The policeman of the future, whether patrolman or detective, will be a trained scientist," continued the chief. "If we are to stem the current of crime, we must do it by scientific methods, and this is what the University of Chicago aims to accomplish."

Future



"We are turning to the study of the mechanics of crime and the mentality of criminals for the control and correction of the anti-social individual. The collection and co-ordination of statistics will form the basis of this work."

While Chief Vollmer looks to prevention as the ultimate remedy for crime in the abstract, he realizes that, under present conditions, the immediate necessity is an understanding of the mechanics of crime—how the criminal does his work and how each criminal worker may be found, identified, convicted, and his further operations checked. For this, he turns to the laboratory and the technical workshop, as he turned with his force of policemen in the city of approximately 100,000 inhabitants, where he is at the head of the department.

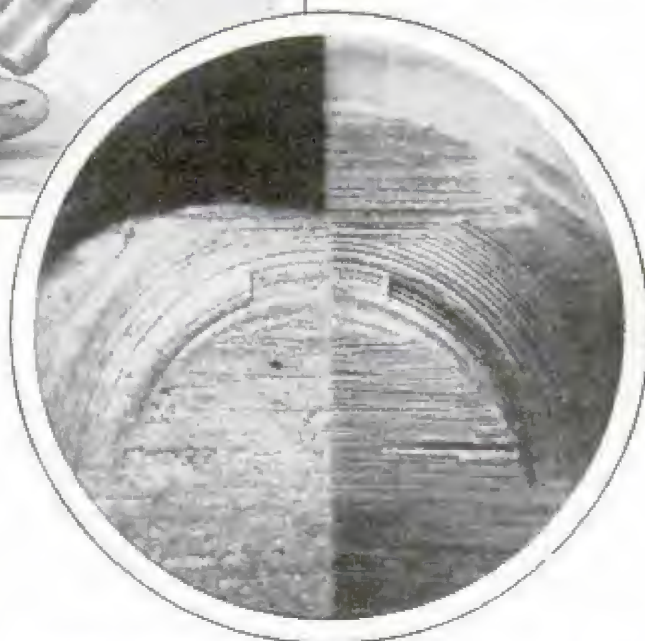
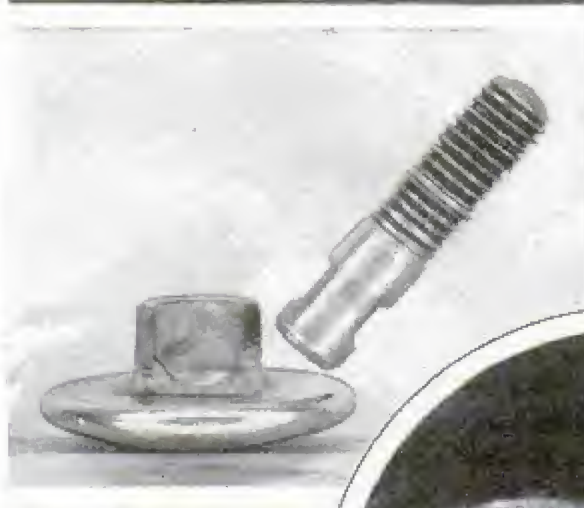
"The University of Chicago plans to set up the preliminary machinery for the placing on a scientific basis of the detection and prevention of crime," the chief continued. "There, men will be prepared with scientific training to be professional



Improved Apparatus for Taking Identification Photographs, and Coroner Herman N. Bundesen Seeking Bullet Clues in Stump



police officials. Mentally, physically and morally, they will be educated as officers of the police 'army' of American cities, just as men are trained at West Point and Annapolis to lead our fighting forces in time of war. At first, there will be offered a course in police organization and administration; then will come a department of police science, and eventually a college of criminology—though it may not bear exactly this title. To science alone may we look for the laws which govern crime. For instance, we know that back of every so-called 'crime-wave,' there is a reason; what that reason is we do not know, but after long comparison of correct statistics on employment, housing, living costs, wages, and many other factors, we will be able to deduce a law which will tell us not only why a series of crimes has been committed in any given community, but approximately when another such series is most likely to occur.



"From the experiences of hundreds of police departments all over the world, we shall be able to deduce laws for the distribution of the police force in any city—a most important factor in the prevention of crime. From microscopic, photographic and laboratory work on dust, hair, finger nails, fibers, foods, tobacco and drugs, will come improved methods of identification. In the future, we shall have patrolmen capable of going into the laboratory and making their own tests, with perfect assurance that they will obtain correct results.

"By means of the lie detector, devised by Dr. John A. Larsen, simple and easily applied deception tests will be developed, and undoubtedly also other means discov-

Inspector Charles P. Carmody, of Detroit, with Murderer's Palm Print; and Paint and Bolt Clues in an Auto Death

ered whereby criminals may be made to reveal themselves and their activities. The identification of criminals is in its infancy as a science, but it is a field in which accurate, unsentimental, mechanical equipment will play an ever-increasing part. The study of weapons and implements used in crimes against life and property forms another avenue leading to identification, a highway on which we have only recently entered.

"It is probable that racial characteristics, as well as individual identity, are revealed by fingerprints. We are beginning to believe that there is hereditary transmission of fingerprints, to such an extent, at least, that lines of descent may be traced. Careful comparison and technical study of these marks alone will establish the laws which govern them, and only in research institutions, where all scientific equipment is available, can such studies be made.

"With the microscope and the camera united for micro-photography, handwriting identification and classification—somewhat similar to the much-needed single-fingerprint classification and co-ordination—will be established. Undoubtedly, back of all handwriting there are certain laws, about which as yet we know little or nothing. Only by mechanical means, possibly by the use of instruments not yet devised, will we be able to learn these laws.

"The vast field of 'methods' of criminals—considered so important that California has established a state bureau for the collection and preservation of its records—is the province of the mechanician. When we have in our files the record telling exactly how every known criminal operates, we shall be able to trace every crime immediately to the person who committed it. It is well known that every safe blower, for example, has his own method of opening strong boxes, differing in some



Mrs. Millicent Cooper, of Lewistown, Mont., an Expert in the Identification and Classification of Fingerprints

constant detail from that of every other safe blower. Virtually every crime against property bears in itself an identification of the criminal. To a slightly less extent, every murder for gain, that is to say, every killing in a holdup, robbery, or burglary, also carries the trade-mark of the killer.

"The automobile has brought to crime a tremendous aid. Traffic regulation is by no means the only automotive problem with which the police have to deal, though this will be studied and taught. Closer checking of purchases, titles, ownership and operation of all forms of automotive vehicles must be made. Probably we shall arrive at the point where the known criminal will be forbidden to own or drive an automobile, so that when found driving, he may be 'picked up.' Without doubt, many crimes could be forestalled by such a legal weapon in the hands of policemen, particularly traffic officers and highway patrolmen.

"What we really need, however, is a systematic nation-wide method for the prevention of crime in its early stages, in place of the often futile attempts to reform criminals after they are well started on their devious careers. Our police school for wayward boys, conducted by Frank

Waterbury, of the Berkeley police department, has been highly successful, and could be applied to any city in this country. The woman in crime presents an increasingly serious problem to every police department. More clever and less easily trapped than man, it is almost imperative that her activities be checked while she is in the adolescent stage. Scientific analysis of the 'underminded girl' from which class is drawn the greater part of the women in crime, will reduce that problem."

Beyond the prevention and detection of crime, however, the University of Chicago is preparing to develop an advisory bureau of police activities for the aid of every American municipality. While the university trains men for the position of police executive, this bureau will take up the crime problem of any city and help that community's police itself to solve the crook question. The primary purpose of the university in taking August Vollmer to its new college, is to organize police work and put it on a business basis, so that, eventually, every American city will have a scientific police force, and will

co-operate with every other city in the prevention of crime and the elimination of the criminal, rather than, as now, merely in the suppression of his activities.

"The plan in a nutshell," said the chief, "is to put the police in the same position in the fight on crime as the physicians of America occupy in their constant battle against disease. Realizing that only by the aid of the mental and physical sciences can we hope to protect society from the crook, we are approaching the problem with open minds. The men at the head of this college of criminology must first

establish definite principles—battle plans of crime—and these can be obtained only through long study and comparison of data on criminal activities from every community in this country. Hence, the new police-science institution will be, first of all, a huge research laboratory, mental and mechanical, and, second, a school for the training of men who will be able, from the information obtained in the laboratory, to carry on the campaign against the 'disease' of crime.

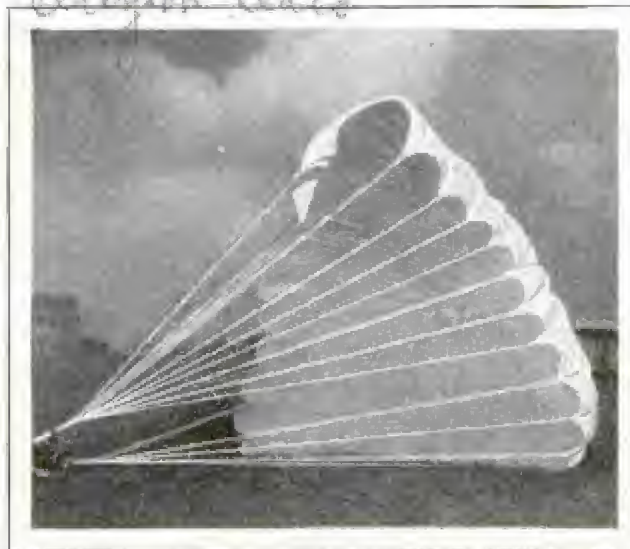


Above, Two Shells Fired from Same Pistol to Show Identical Markings, and, Below, Test and Fatal Shells in Detroit Holdup Case; They Led to the Murderer's Confession

"Apparently there is a direct relation between the number of automobile registrations and the number of robberies of all kinds in every city. There seems to be a relativity between the comparative employment of women and men in a community, and the number of crimes committed there. It is suggested that there is a traceable relationship between the prosperity of a city and the number of crimes against property. But at present we do not know the laws governing these relationships. That there are such laws, there can be little doubt, and when we know them, we shall know not only with what kind of crimes but what sort of criminals we shall have to deal in every community. Moreover—and this is equally important—we shall know approximately when, in the future, we shall be confronted with a series of crook activities."

TRI-CORNERED CHUTE REDUCES LANDING SHOCKS

Slower landing speed with resulting decrease in the shock and improved maneuverability are features claimed for a triangular parachute developed by Maj. E. L. Hoffman and tested with satisfactory results at Wright field, the Cleveland airport, and other places. The principle of operation remains practically unchanged as to the method of opening and other details, but instead of being round, the new parachute has two rounded corners, while the third is straight. There are no shroud lines across this square corner, which thus forms a tail-like vent through which the air can escape, enabling the canopy to be propelled horizontally at varying speeds according to wind conditions and the action of the jumper. The chute is also said to swing but little, the pilot parachute has no springs and, when folded up, it is said to be more comfortable to wear.



A Tri-Cornered Parachute Which Is Able to Land at a Lower Speed Than the Round Ones

GUN THAT PATCHES SUBMARINE ALSO AIDS IN RESCUES



A "Fixer" Which Plugs a Hole in a Submarine as Easily as an Inner Tube Is Patched

Holes in sunken submarines can be repaired about as quickly as a patch is placed on an inner tube, according to reports, with a submarine "fixer" recently introduced and tested at the navy yards. It weighs fifteen pounds, is about two feet long, and, working on the principle of high explosives, although it is said to make no loud noise and is safe to use, drives steel pins through the steel of the submarine so that a patch can be tacked on in a short time. Navy experts point out that the device can be used in different

ways. In case men are trapped inside the hull, hollow pins could be driven through the hull so that liquid foods could be given to the prisoners or signals could be exchanged. The fixer is easy to use. It shoots a steel pin three and one-half inches long and half an inch in diameter through the five-eighths-inch side of a sub.

no further information

*see May 1932. 795
Raymond G. Temple, 120 Lexington St. Boston, Mass.
Cm. James H. Miller, Dayton 304 W. Leprace
Temple, 120 Lexington St. Boston, Mass.*

THESE TUBES DO WORK OF THREE HUNDRED BOYS



Pneumatic Tubes in a New York Office Building Which Handle over 20,000 Messages Daily, a Task That Would Require the Full Time of More Than 300 Messenger Boys

Pneumatic tubes are being employed to do the work of messenger boys, particularly in large office buildings. The New York Life Insurance building, in New York, is equipped with pneumatic tubes which shoot the leather carriers containing the messages up seventeen floors in seven seconds. Thirty-six operators are required to man the tubes, which deliver more than 20,000 messages daily between various departments, a task that would require the employment of 300 messenger boys. The tubes go to the basement, where all messages are rerouted and sent on their way in other tubes. Telegraph companies have pneumatic tubes, extending over many miles, connecting their branch offices in some of the larger cities, and newspapers are in communication with press-association offices in like manner, the news of the day flashing into the newspaper offices after traveling under the streets in the pneumatic carriers, often at a speed of fifty miles per hour. Some of the underground tubes used by telegraph companies have been operating efficiently for more than fifty years.

PROFIT IN TIN CANS

Salvaging millions of tin cans around western mining camps has been found a profitable business. The process recovers both the tin and the steel, an average of three tons of tin being recovered weekly and molded into ingots to be used for making new cans. The labels are removed by a mangling and shredding machine, the tins are crushed and put through an incinerator, and then go into a chute of churning water from which they pass to a vat of caustic solution which separates the tin from the steel. The steel then is pressed into compact form for shipping.

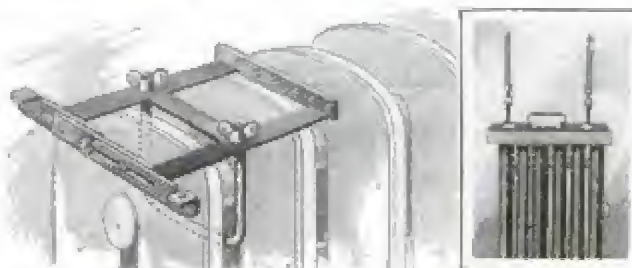
Initial: Kennedy & Co.
18578 25th St. N.Y.C.

ICE WELL IS GOOD REFRIGERATOR FOR DAIRY

Ice wells for cooling and storing milk and cream on the dairy farm where the usual methods are too expensive or impracticable, have been tested with satisfactory results by the North Dakota Agricultural college. The ice well consists primarily of a pit in the ground in which a large solid cake of ice is formed by running a small quantity of water into the hole daily during freezing weather. The spot selected should be well drained and near both well and milk house. The experimental well was eight feet square and nine and one-half feet deep with boarded sides and gravel bottom, a small house being erected over it. During the winter months a solid cake of ice, eight feet square and six and one-half feet deep, was frozen. Storage was started in May and fifty-eight cubic feet of ice still was left in September.

SHELF BRACKET FOR RADIATOR GIVES EXTRA TABLE SPACE

Radiator shelf brackets now are on the market to make available the heretofore waste space on top of radiators. One bracket serves a radiator of three or four sections, and two care for that of ordinary width. The brackets are attached by wing-nuts, and may be extended or contracted to the width of the radiator. They may be used to transform radiators into tables for various purposes, window seats or book shelves.



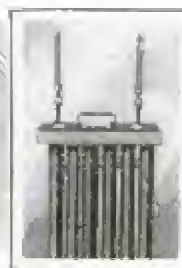
Shelf Brackets for the Radiator Which Transform It into a Table or Window Seat



Sound Waves from a Siren aboard This Airplane Operated to Turn on Searchlights on the Landing Field 2,000 Feet Below

LIGHTS TURNED ON BY SIREN ON SPEEDING PLANE

Operation of sound-control apparatus, which enables aviators to turn on the lights of air ports while high over landing fields, has been successfully demonstrated by engineers of the Westinghouse Electric and Manufacturing company. In the tests, a big horn, resembling those used on old-fashioned radio loud speakers, carried the sound from the siren, 2,000 feet above the earth, to the delicate control apparatus. This apparatus clicked softly, and immediately the huge searchlights blazed forth, throwing beams of light that could be seen for miles. Since only one tone operates the control apparatus, all other noises have no effect.



Chicago & Co. Edwards, 1617 Thorne Ave

3347

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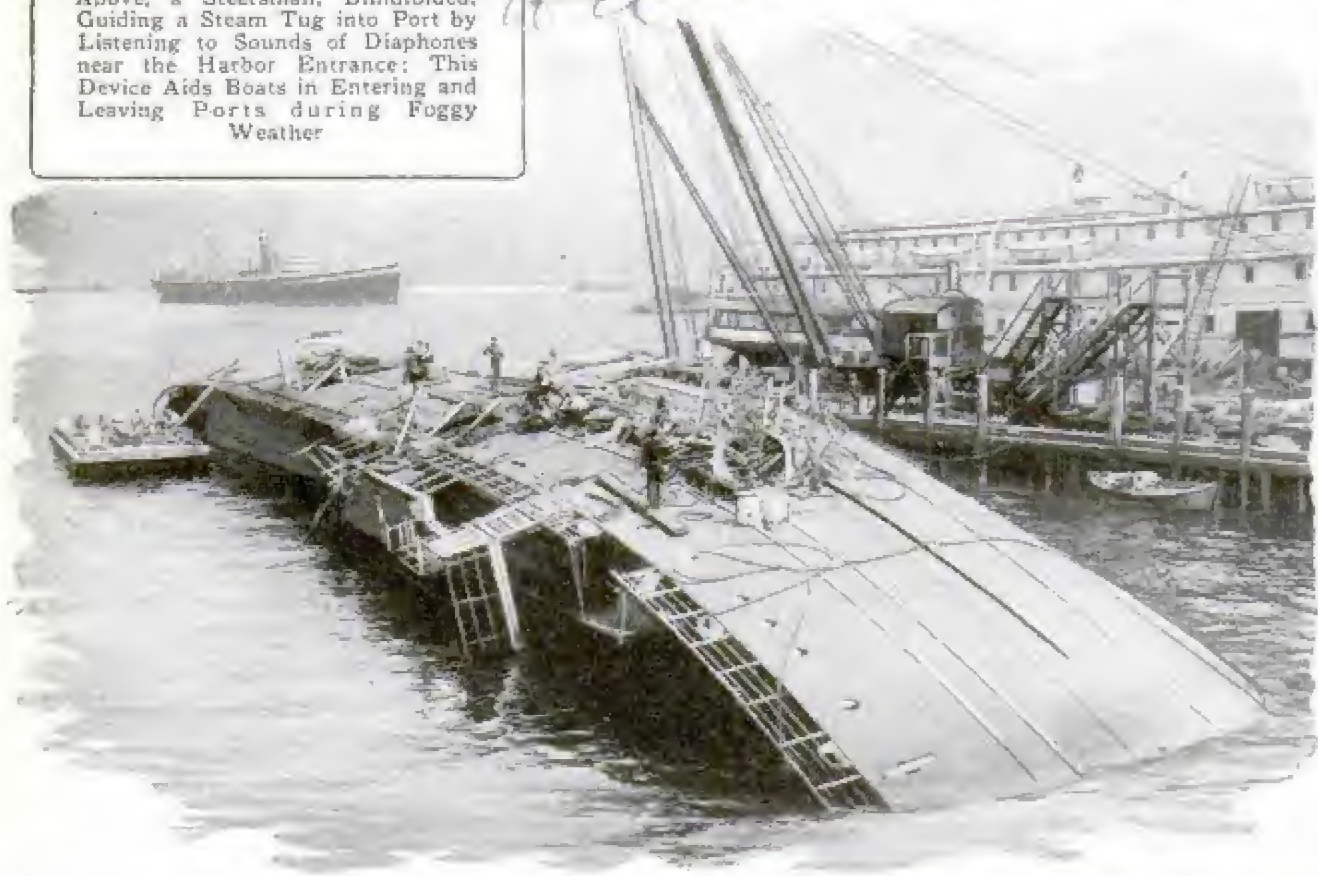
Strange Adventures in

By HAROLD T. WILKINS

AROUND the walls of a room known as the "Graveyard" in the Royal Exchange, the home of the famous shipping corporation of Lloyd's, London, are many hundreds of green-backed volumes telling strange tales of adventures at sea.

The records range back for more than a century, yet, even in these scientific days of transatlantic radio telephones from ship to shore, direction finders and echo-sounding devices against the perils of fog and

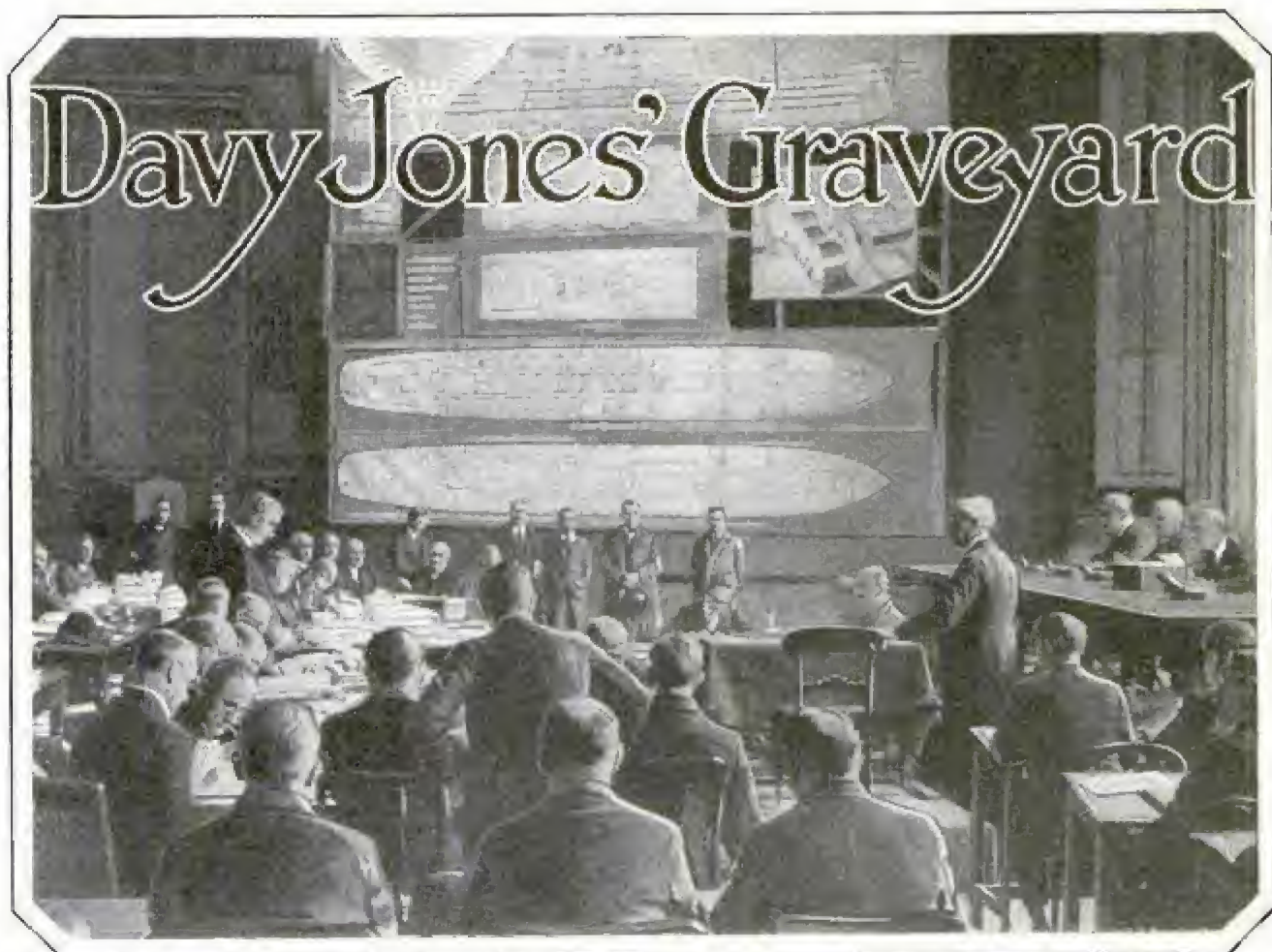
Above, a Steersman, Blindfolded, Guiding a Steam Tug into Port by Listening to Sounds of Diaphones near the Harbor Entrance; This Device Aids Boats in Entering and Leaving Ports during Foggy Weather



The S. S. "Kershaw," Being Raised after Catching Fire and Sinking. While Undergoing Repairs at Baltimore

darkness, Lloyd's are continually adding to these secret archives tales as true and strange as any ever written in the far-off days before the first paddle steamer

Davy Jones' Graveyard



Scene at British Inquiry into Sinking of the "Vestris" with a Loss of 114 Lives; Plans of the Liner Are Displayed on the Walls; It Was Decided That the Vessel Was Overloaded

churned the waters on the long track from Liverpool to New York.

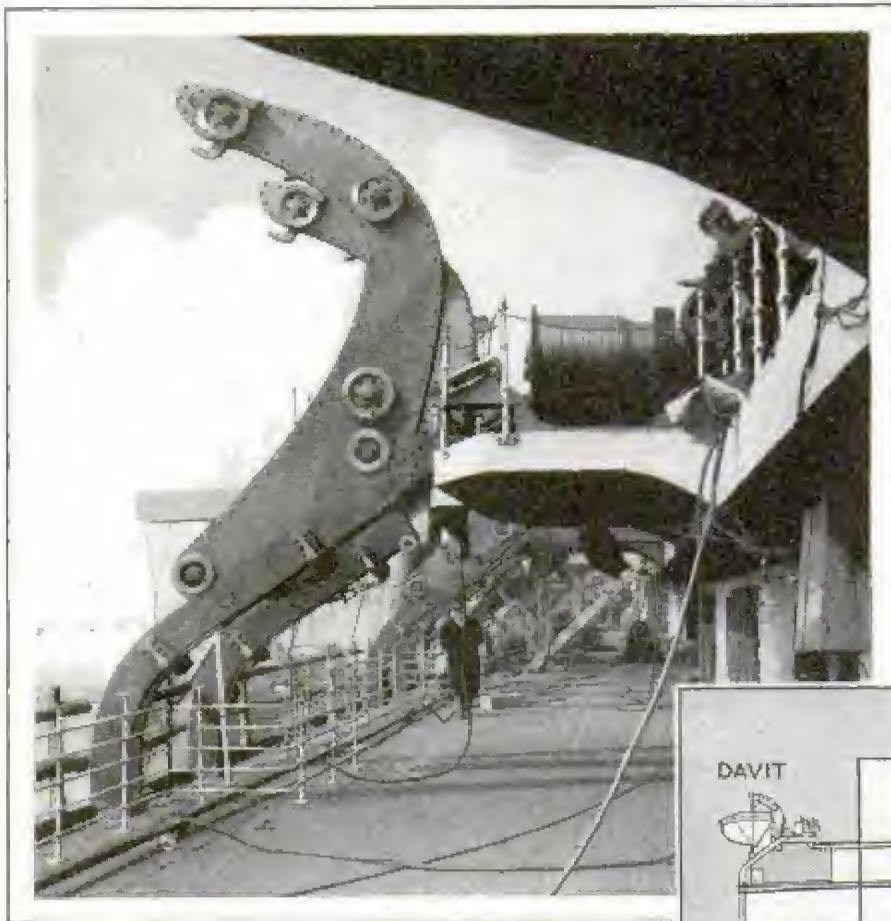
Many of these skeletons in Davy Jones' cupboard are never revealed to newspaper readers. Some of them are in the shape of genuine bottle messages cast ashore years after a startling sea disaster. A few months ago, a man was walking at evening along the sands of a quiet bay, the Mumbles of Swansea, South Wales, when he picked up a bottle containing a note, a gold scarfpin with a stone missing, and a photograph of two men. Said the writer: "This is the last moment the great ship 'Titanic' sank. I am left here with my brother-in-law, John Williams, wife, and little child Jean, having left the doomed ship on the last boat. The band are still playing, the officers are running here and there, although their tasks are hopeless; men are going mad, while. . . [unreadable]."

This tragic last message, so strangely cast up from Davy Jones' graveyard in 1929, seventeen years afterward, throws light on the last moments of the liner "Titanic," which collided with an iceberg in

mid-Atlantic on her maiden trip, on April 15, 1912, when she sank with 1,635 passengers out of a total of 3,510 on board.

On December 14, 1928, a steel three-masted barque, the Danish sailing ship "Kjobenhavn," sailed from Montevideo, Uruguay, for Melbourne, Australia, with fifty naval cadets. Cables and radio reported ice floating in the southern ocean right along the track she would take. She was a 3,901-ton ship, said to be the world's largest sailer, and carried no able-bodied seamen, but was to be handled by the cadets. Her radio had only a short range, and to reach shore stations messages would have to be relayed by passing ships. Auxiliary motor engines could have driven her one screw, in case of need. Seven days after she left Montevideo, she sent a message regarding her progress, then nothing more was heard.

Next, on June 18, 1929, the cables hummed with a message when Capt. H. Kristensen of the motor ship "Mexico" came into Table bay, Cape Town, with a riddle to solve:

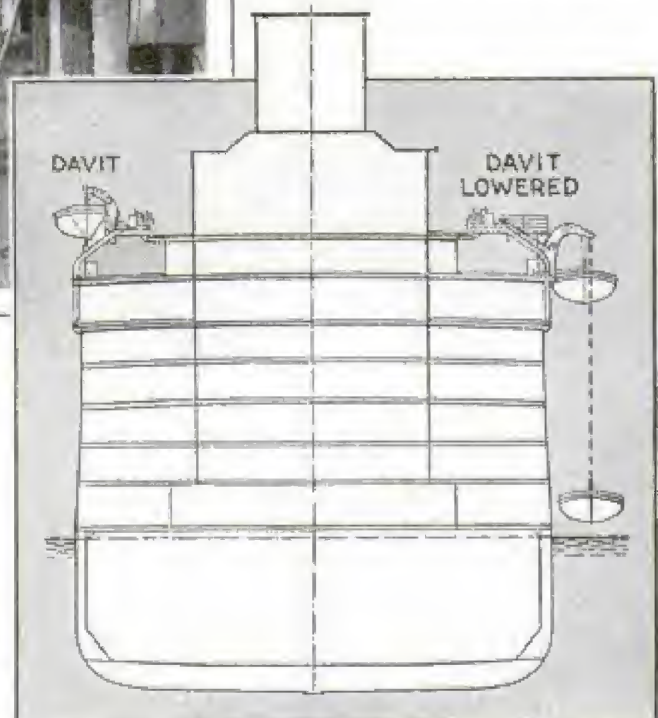


Above, Davit for Launching Lifeboat from German Liner "Bremen"; at Right, Method of Operation

"I find that on January 21 last the 'Kjobenhavn' passed Tristan da Cunha, with her sail reduced to a single jib, and fore, lower and topsail. Other sails carefully stowed and furled. She came drifting on the current, a quarter of a mile off Tristan reef. Nobody was seen aboard, and her helm was unmanned. When she was near striking the reef, she turned and the current carried her into the mist, in which she vanished. It is as puzzling as the 'Marie Celeste' mystery. Either the 'Kjobenhavn' had been abandoned or her whole crew was down with disease or poisoning. The islanders are sure she was undamaged, but slightly down by the stern. I reckon she is still afloat or has been washed up on the desert coast of southwest Africa or in the Antarctic."

The tale of the "Eltham" steamer is a strange one. The villagers of the lonely Cornish hamlet of Chapel Porth woke up after a night of roaring gales and tumultuous seas, on November 18, 1928, and walked down in the gray dawn to the edge of granite cliffs, where they looked down on a steamer, lying 200 yards from the

shore with a broken back. Fishermen put out in boats to the submerged wreck and found she was the "Eltham," a 687-ton steamer owned by a Liverpool firm, and bound for Rouen, France, with a cargo of coal from Swansea, which she had left the previous Thursday. There was no sign of her crew, and coastguards near by had seen no flares or rockets in the night. A few hours later,



a smashed lifeboat, bearing the name "S. S. Eltham," was washed ashore in a cove six miles away. Many small and storm-bound ships lay at anchor in near-by havens, but none had sighted the "Eltham" when they fled from the hurricane.

Ten days later, the seas abated enough for a volunteer fisherman to board the wreck of the "Eltham" at low tide, with a life line tied to his waist. He found the steamer badly holed, but no logbooks or papers of any kind. Her anchors and chains were stowed away, but there was no sign of any cargo. Fittings had been washed away, but engines and boiler were still intact, and there was nothing to show why the crew had abandoned her, save for the hole in her hull, which might have



The Crew of Twenty-Five of the German Freighter "Quimistan," Just before Their Rescue by a Steamer; the "Quimistan" Took Fire, and the Crew Spent Three Days in the Boat Shown

been due to breakers on the shore. Was the "Eltham" deserted many miles away in mid-Atlantic, and did she drive derelict to her doom with no crew aboard? If so, what became of her cargo?

"SOS. Urgent. Explosion!" was the startling message received by the French tug "Iroise," waiting with steam up off Brest, in December, 1928. There was no statement of the distressed ship's position, or her nationality or name, and the mystery remains as insolvable as the fate of the survivors of the American oil tanker "David C. Reid," which, in the previous month, wirelessly the Leyland liner "Delilian" that she was sinking fast. The American tanker passed Gibraltar, at the southern tip of Spain, on October 6, 1928, on a voyage from Samarang, Java, to Philadelphia. When the Leyland liner reached the position given in the SOS, all she found was a great patch of oil on the ocean. Then there is the queer story of the 420-ton Latvian steamer "Laima," missing since January 25, 1929, when it is supposed she was lost with all hands in a gale in the Baltic sea. No lifeboats or wreckage were ever found, and the theory is that the steamer became incased in ice,

and was overwhelmed by gigantic waves.

The Atlantic, in 1929, has maintained its reputation as Davy Jones' graveyard. During a tremendous gale and icy seas in January, liners and freighters from all quarters were rushing to the aid of an American tanker, an Italian freighter and the West Hartlepool cargo steamer, the "Teesbridge." At 5:30 on a Monday morning, the American freighter "Maine" heard a desperate SOS from the "Teesbridge," then about 400 miles east of Cape Race, Newfoundland: "Water in stokehold. Two hatches stove in. Using emergency wireless. Latitude 48.31 N. longitude 41 West." The "Teesbridge" had a crew of thirty. When the captain of the "Maine" reached the spot, he saw no trace of the ship or wreckage and hung around till next day. A Belgian liner and a French freighter joined the search, with no better luck. No one knows if the position was wrongly reckoned by the "Teesbridge" or whether her wireless transmitter was put out of action after great seas had drifted her away from the position she indicated.

A strange tale of an explosion heard at sea, off Yarmouth, England, on the night of Sunday, July 7, 1929, adds another grim

skeleton to Davy Jones' cupboard. The captain of the Swedish steamer "Anne Berg" was in the chart room working out his course to pass a lightship, when he was struck motionless. "I heard a tremendous explosion reverberate across the water," he said; "the helmsman shouted to me and I jumped up to the wheelhouse. I was just in time to see a vessel, about four miles away across the port bow, disappear into the sea. She went down at an angle of about sixty degrees, and I saw only the head and foc'sle of the ship. The rest of her had already gone down. We steered at full speed to the spot, reaching it in twenty minutes. There was no sign of wreckage—not a piece of wood or oil or anything. I reckoned, from what the helmsman told me, that she was a ship like our own, Swedish and about 3,000 tons. We sent out an SOS and North Foreland wireless station told us a gunboat and a mine sweeper were rushing to the spot. We gave the exact position. About midnight, the British mine sweeper 'Selkirk' came alongside and hailed us, and we told her by Morse lamp that she was in the correct position. We said we had seen nothing,

and asked if we might proceed, and the 'Selkirk's' commander wirelessly: 'Yes, thank you very much.'"

The gunboat and the mine sweeper searched the sea for hours without result.

There also are "ghost ships" in Davy Jones' graveyard. A Dutch liner, not long ago, reported boarding a tramp steamer in the vast Caribbean sea, which seemed derelict. The only living creature they found on board was a big retriever dog, frantic with fear. Down below, steam was still in the boilers but shut off from the engines, and in the chart room, a pen with the nib "still wet with ink," was found in the pages of a logbook. The Netherlands saw no signs of storm or strife, but two lifeboats and a skiff were missing. Then a French sailing ship, the "Emilie Gallieni," was passing through the Straits of Magellan when she had an adventure which sounds like an episode from a novel. Icebergs and dancing green flocs packed the waters and the captain was steering his ship gingerly toward clearer water when he saw a vast iceberg, and in a fissure, 120 feet above the sea, was entombed a big three-masted sailing ship,



© Topical Press

A Scene at Lloyd's, London, Where the Records of Every Ship in the World Are Available and May Be Looked Up in the Index in Less Than One Minute

all her sails and rigging intact and not a boat missing from her davits. The crew of the French ship shouted, but no response save the echoes of their own voices came from the weird berg.

This incident may be contrasted with another true story. Let the reader imagine himself penned in a narrow steel tomb in a steamer's engine room, under the boilers, while flames roar over him and he lies in water which grows hotter and hotter till it nears the boiling point. Such an incident actually occurred in October, 1928, on board the Blue Star oil tanker "Trojan Star" in mid-Pacific, bound for Vancouver. An oil jet burst and a rush of flame cut off eight of the engine and stokehold staff, who had to seek shelter in the bilges under the boiler, while for three hours they lay in oil and water, and flames roared above them. A Welsh

fireman sang songs to keep up the spirits of the sufferers. Then a steam pipe burst and the escaping vapor smothered the flames.

The strange tale of the liner "Waratah," a new ship carrying 300 passengers and crew, which, in July, 1909, mysteriously vanished between Durban and Cape Town, South Africa, right in the track of ten other steamers all of which safely reached port, had light thrown on it in May, 1929, when an Englishman wrote to a well-known London newspaper stating that, in 1913, he met a white trader at the mouth of the river Xora, near the native reserve of the Trans Kei, near East London, South Africa, who told a queer story. "One very wild night in July, 1909," he said, "I saw a large steamer close inshore off a dangerous coast with terrific surf running on razor-edge reefs. Wondering what on



© London Daily Mail

The Submarine in the Middle, Pictured Shortly after It Had Collided with and Sunk Another British Sub

earth she was doing in so dangerous a spot right off the steamer track, I went to my hut to get my night glasses, but on returning to the shore, I found the steamer had vanished. Three months later, I heard of the loss of the 'Waratah.' I am certain it was the same steamer. I have a piece of wood with the letters 'War' carved on it. A tremendous depth of water runs outside the reefs and it is quite conceivable that a ship could turn turtle and leave no trace. Sharks would kill any human being even if he or she could keep afloat in such strong tides." One theory of the disappearance of the "Waratah" is that she was top-heavy, and went to the bottom, after turning turtle in a hurricane.

❑ Coal has been found 800 miles north of the arctic circle.

DUMMY LEAPS FROM AIRPLANE TO TEST PARACHUTES



A Dummy Dropped from an Airplane by German Aviators to Test New Parachutes

German aviators have constructed a dummy to test their newly developed parachutes. The dummy, with the parachute strapped to its back, is carried aloft fastened to a rope outside the plane, and when at the proper height, is released. The observers take notes on the time required for the parachute to open and the manner in which the dummy lands.

SPEEDWAY FOR AUTO TRAFFIC OVER RAILROAD

Utilizing air rights over railroads for automobile-traffic speedway purposes is anticipated in Detroit, where the Grand Trunk system is planning a twenty-six-mile toll road above its tracks from Detroit to Pontiac, Mich. The total cost of the project, including electrification of that portion of the railroad, is expected to be \$100,000,000. The plan includes construction of a four-track electrified railway surmounted by a forty-foot motor speedway, supported by steel pillars. Throughout its length, the highway will pass over streets and railroads, there being no traffic lights to delay motorists. It

is planned to divide the road into zones, the charge being based on the number of zones the motorist traverses. Four streams of traffic are anticipated, the inner one on each side being for high-speed travel. Traffic will enter and leave by ramps.

CHINESE FISH WALKS ON LAND

Home aquariums now may avail themselves of a Chinese fish that is almost a landlubber. If taken from the water and placed on land, the fish crawls along the ground and, it is claimed, will cover half a mile in this fashion. The walking fish is several inches long and is beautifully colored, with a bright spot resembling an eye near the tail.

SPHEROID SHAPE OF OIL TANK GIVES ADDED STRENGTH

Oil tanks of spheroid design have been found by tests to be more economical and to be stronger than the cylindrical containers for large-capacity requirements. The spheroid tank with flat bottom was designed to make the shape as near as possible that taken by a flexible container under gas and liquid pressure, as illustrated by partly filling a rubber balloon and placing it on a flat surface, whereupon it becomes a spheroid, circular in plan but with a flat bottom. In the ordinary cylindrical tank, the bursting force is resisted by the vertical shell, but in the spheroid considerable pressure is transferred to the top and bottom of the container. High stress near the bottom was lessened by curving the container sharply there.



Huge Oil Tanks of Spheroid Design Have Been Found Stronger Than Cylindrical Ones

AUTO TRUCK HAULS SIX HORSES EACH IN OWN STALL

Transporting horses and cattle by motor is simplified by a truck, designed especially for this purpose, which hauls six horses, each in an individual stall. The stalls are removable so that the truck may be used for other hauling. The animals enter from the side, the side boards dropping



Truck Containing Individual Stalls for Six Horses, the Sides Dropping Down to Make a Runway for the Animals

down to make a runway. When the side-walls are in place, sufficient space is provided at the top for the heads of the animals to protrude outside the folding runway doors. A cleated runway is provided to be placed over the sidewall runway when it is dropped on its hinges.

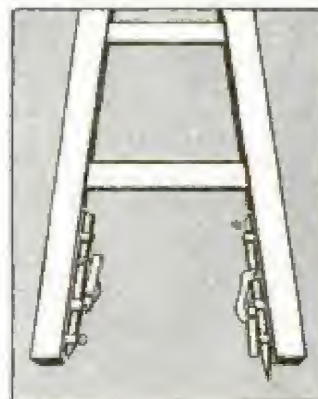
ANESTHETIC TAKES AWAY FEAR OF SURGEON'S KNIFE

Removing most of the apprehension which many patients suffer before an operation, an anesthetic has been developed which has fewer unpleasant aftereffects and involves less danger than many other preparations used for the same purpose. It goes under the impressive name of "iso-amylethyl barbituric acid" and was found during experiments to offset bad effects of some local anesthetics, including poisoning, convulsions, nausea and vomiting. The anesthetic has been used experimentally and for the benefit of patients more than 1,000 times and, in no case, has there been poisoning or convulsions, and nausea has been greatly lessened or entirely

eliminated, while it was also found to quiet the patient before operation and to add to comfort afterward by producing a semiconscious state lasting for several hours. More work must be done, however, before the anesthetic is brought into common use.

LADDER IS KEPT FROM SLIPPING BY ADJUSTABLE RODS

Dangerous slipping of ladders is prevented by a German invention consisting of sliding rods mounted at the bottom of the ladder in eyes that form an integral part of a plate attached to the sidepieces. The rods are drawn downward in operating position by a lever and link pivoted to the mounting, and locked in the desired position by



the lever. The safety equipment adds but little to the ladder's weight.

☐ The antelope is the swiftest of North American mammals.

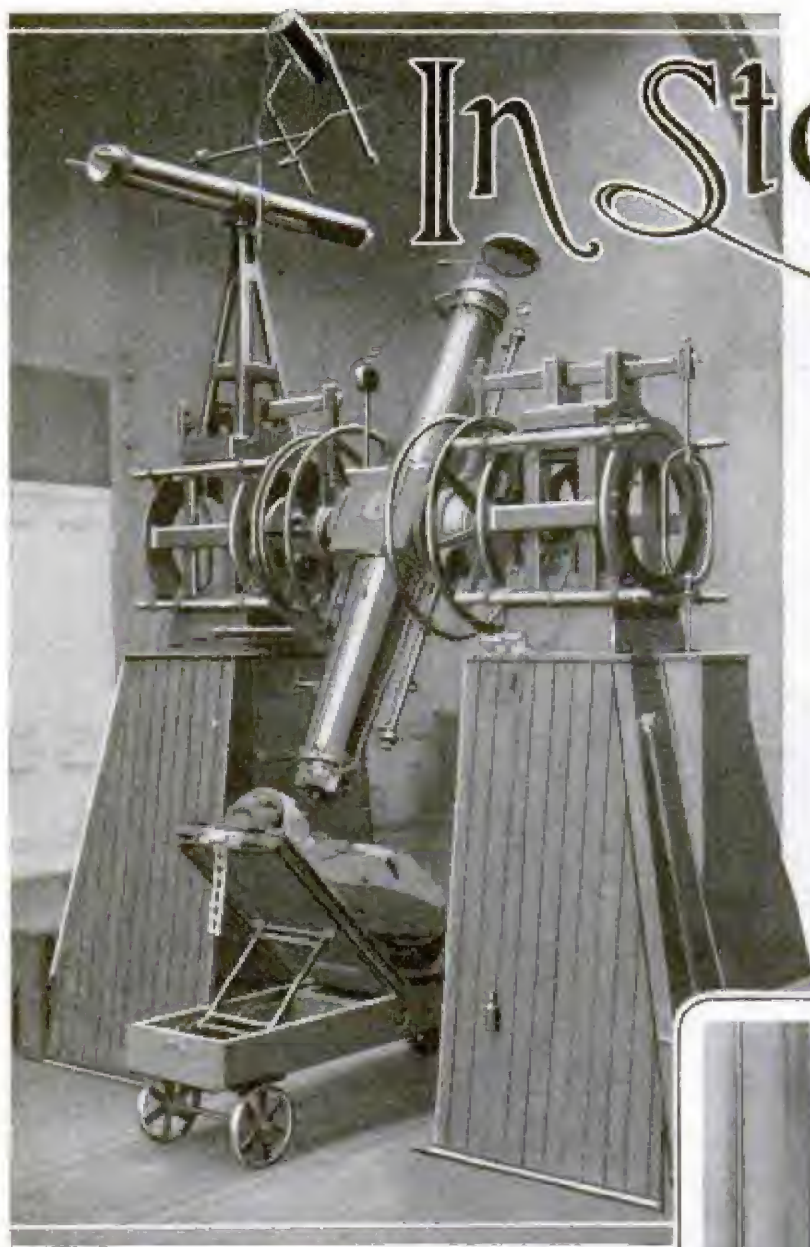
Pharmacology
 University of Kansas

Professor
 Dr. H. S. Sargent

Rich Bruch, Magdeburg,
 Fabrikant
 Germany.

Wm. J. Smith
 High Street, Rochester

3230



In Step With

by only thirty seconds, many people and governments would suffer losses and disappointments. Radio messages would become garbled, astronomical predictions would mislead navigators, and nations would be cheated of land.

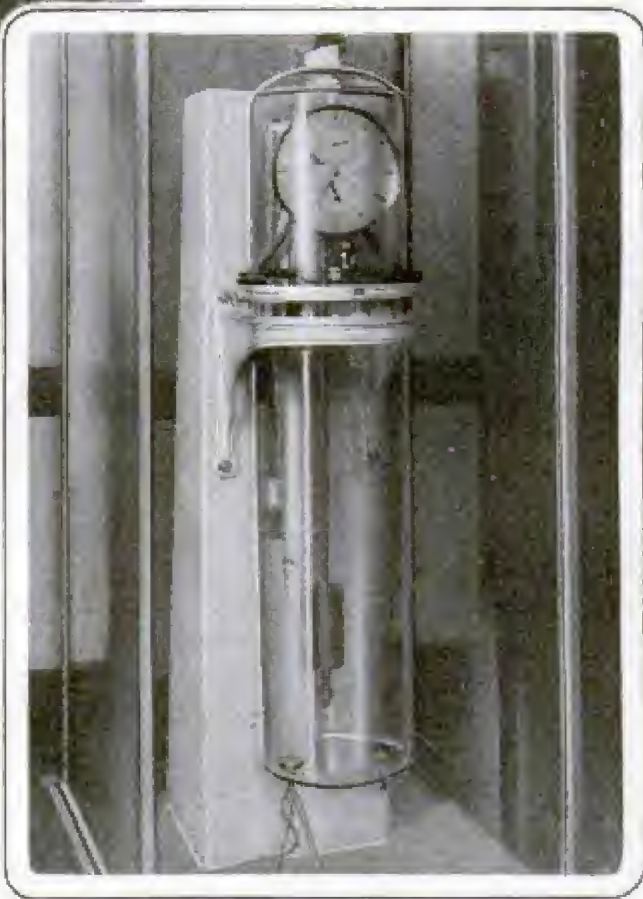
The pineapple planter and antarctic explorer each go to lunch at the exact stroke of twelve. Chronometer manufacturers are slowing down production because skippers depend less and less on cabin timepieces. But the radio announcer,

By DON GLASSMAN *un*

"STAND by!" sings out the radio man; "We are about to broadcast the correct time. When the gong strikes, it will be one minute and forty-five seconds after nine o'clock, eastern standard time."

People were never more punctual and precise. In this age of swift tempo, we have gone beyond splitting mere minutes. Machines grind, trains roar, airplanes fly and ships sail on schedules having a startling approximation to the astronomical events. Seconds are split!

The Pacific fleet, steaming over the Arafura sea; the Atlantic fleet, bucking the Gulf Stream swell; a tramp freighter rounding the Horn; a whaler docked at Reykjavik, and the Byrd antarctic expedition—all have their routine attuned to the stars. If the world were out of step



Observing "Clock" Stars through Transit Instrument, and, Below, Master Clock That Keeps Time for the United States

The Stars



Queer Observatory in India; the Units Represent the Signs of the Zodiac, the Courses of the Planets and Various Other Phenomena; Calculations Are Computed According to Shadows Cast by the Luminaries

skipper and pineapple planter are not experts in astronomy. How do they know when the clock strikes twelve? Merely by setting their watches to the rhythm of the universe as broadcast by the United States naval observatory.

The greatest clock face has a diameter of billions of miles. It is the sky. "Clock" stars move across the heavenly vault with such precision that it is possible to chart their movements years in advance. That is a vital part of the observatory's business. As our earth rotates, the stars appear to rise in the east and set in the west like the sun. The positions of stars are only slightly affected by the revolution and rotation of the earth. On a proportionate scale, the globe is merely racing around a tiny back-yard track, and all its motions are hardly perceptible when one considers the dimensions of the heavens. The stars swing overhead in a great arc. They march in solid phalanx—regiments battalions and companies. In Washington, the observatory has erected a fixed six-inch telescope whose eyepiece is bisected by a hair line. An astronomer con-

sults a printed table and notes that a certain star is scheduled to cross the observatory's meridian or "finish" line in five minutes. The star looms suddenly. It seems to move, but really it is the earth's rotation that brings the star across the hair line.

The observer operates an apparatus which causes interruptions in an electric circuit. The interruptions are recorded on a sheet of paper fixed round a cylinder, the chronograph or "time writer." The same sheet records the ticks of a standard clock. Comparing the two graphs, it is simple to determine the difference of clock time from astronomical time. Then the standard timepiece, made of gears and springs, is adjusted to the rhythm of celestial mechanics. The stars are relied upon to settle all arguments. For ascertaining daily time, observations are made on eight or ten clock stars. The average of these determinations is broadcast to the world.

Determinations of correct time by two expert observers usually agree within .002 of a second. A layman can hardly imagine



business. School gongs ring at nine o'clock and factory whistles blow at five. Fair or stormy, time is inexorable in its flight. When skies are clouded, the world must rely on mechanical inventions for the correct time.

Three standard clocks at the observatory are hidden in a basement vault, under uniform temperature and air pressure. These clocks keep sidereal, or star, time. They are never

what lofty mathematics enter into such a calculation. Weird symbols and signs invented by the ancients and inherited by Einstein play roles in this performance. These hieroglyphics do not interest people who think in simple digits. What the nation at large cares about is how accurately the observatory delivers daily time. Consulting the latest data, I find that the average error is .031 second. The observers admit that on two occasions in the past year their errors crept up to .44 and .62 second. They offer apologies and ask you to remember that normally their maximum error is .19 second.

Every clear night, a naval observatory astronomer lies on a couch and consults the charted heavens. If the sky is overcast, he cannot observe. Consequently, millions of clocks march out of step, and there can be no adjustment until the vapory curtain melts. While astronomers wait on weather, the world goes about its



Clock and Switchboard That Control Time-Sending Wire Circuits, and the "Three Sisters of Arlington" Where Time Signals Are Sent

touched by hands, save for necessary repairs. They have pendulum rods that do not change with temperature variations. These timepieces have a tendency to run fast. During the first year after cleaning, their daily rates are likely to increase one-hundredth of a second per month. But the actual increase is not so important, so long as it is regular. At present, the rate is about .01 second per day.



Aerial View of the United States Naval Observatory Grounds, Where the "Rhythm of the Universe" Is Interpreted in Correct Time and Broadcast to Widely Scattered Points throughout the World

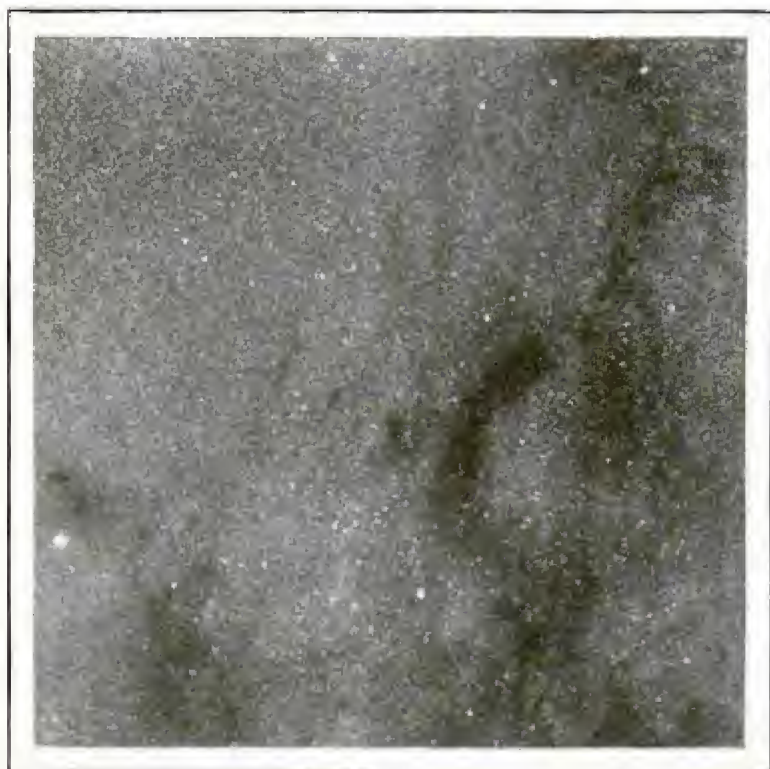
The standard clocks are linked by a telegraph circuit to what is called the transmitting room. A transmitting clock coincides at all times with the standard timepieces. Thrice daily, at noon, 3:00 a.m., and 10:00 p.m., the transmitting room sends telegraphic time signals. The human voice takes no part in this performance. Telegraphic wires sound the seconds as sharp clicks, and the radio sounds them as buzzes. Signals begin five minutes before the exact hour and end on the last second of the sixtieth minute. An ingenious way has been devised to denote the end of each minute and half minute. The ticker is silent for the fifty-fifth, fifty-sixth, fifty-seventh, fifty-eighth and fifty-ninth seconds. After this pause, listeners-in know that the very first click will mark the birth of a new minute and the death of an old one. To denote the end of a half minute, the tickers omit the twenty-ninth second.

After these delicate operations are completed, the observatory's responsibility

ceases. The telegraphic pulse beats are picked up by six wires leading from the transmitting room. Via telegraph and wireless, the navy broadcasts correct time all over the earth. The air hums with electrical waves that streak around the globe seven times in one second. Battleships, merchantmen, islanders, explorers, even aviators may tune in on correct time.

Impulses speed to Annapolis over leased wires. Signals from NSS, the navy wireless, are very powerful and may be picked up in most parts of the world. The telegraph companies rent thousands of clocks that are geared to master hands at the observatory. They, too, have standard clocks for use in case telegraphic communication should suffer interference. Ordinary broadcasting stations obtain correct time from rented clocks.

A century ago, people were content with the time calculations of sundials. Radio and telegraph were unborn. Early in the forties, the observatory began to



Part of the Heavens' Great Clock Face, the Most Accurate Time-piece Known and the One That Keeps the World in Step

drop a time ball from the building's roof. If a citizen happened to pass, he might adjust his watch. During Lincoln's administration, the observatory began supplying Washington fire stations with signals over wires ordinarily used to ring alarms. Then a telegraph operator thought it would be novel to tell his colleague in Baltimore when to cease work. And the key man in Baltimore relayed the signal down the line. Norfolk and Annapolis told Charleston, Charleston told Savannah, Savannah told Key West. Before long, telegraph operators from Portland, Ore., to Portland, Maine, were enjoying the convenience of correct time. At length the citizenry learned of this innovation, and the age of rented clocks was the upshot.

COST OF MAKING ELECTRICITY

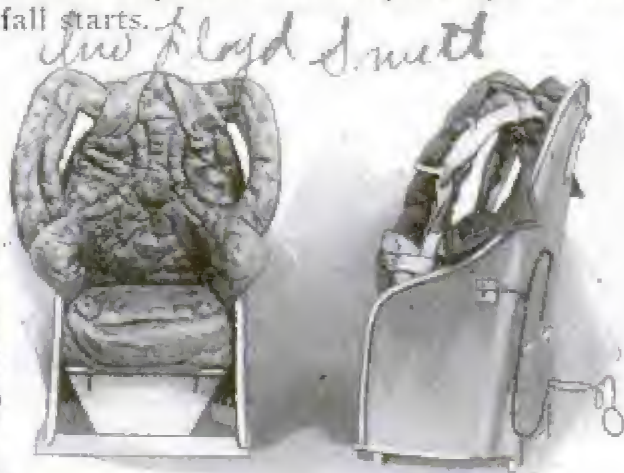
Generation today constitutes only a small part of the cost of electric service. Except in special instances, it varies from a little less than one-half cent to a little more than one cent a kilowatt-hour, depending on conditions. Carrying the power to the consumer, including the expense of poles, towers, wires and the land these occupy, and the loss in transportation, constitute the bulk of the expense,

and added to this is the cost of distribution to each individual consumer after the power has been transported in bulk. Transportation of electric power from producer to consumer is unique in that the product cannot be made in advance except to a very limited extent, and cannot be stored up in slack seasons for the busy periods.

PARACHUTE AND SEAT COMBINED FOR AIR SAFETY

Greater safety in the air for passengers is afforded by a combination seat and parachute which allows the pilot, in case of danger, to discharge his passengers through the floor of the plane, the parachute opening automatically to bring the passenger to earth in

the seat he occupied in the plane. In an emergency, the pilot throws a lever which simultaneously releases the upholstery from all seats, springs raising upholstery and harness up and forward over the shoulders of the passengers to afford protection. Passengers insert their arms through large holes in the harness of the parachute and fasten two snaps, the operation requiring less than two seconds. The control wheel then drops one passenger each eighth of a turn, one normal turn releasing eight passengers. A pull ring to open the parachute is carried in a pocket on the left side of the upholstery within easy reach of the passenger as the fall starts.

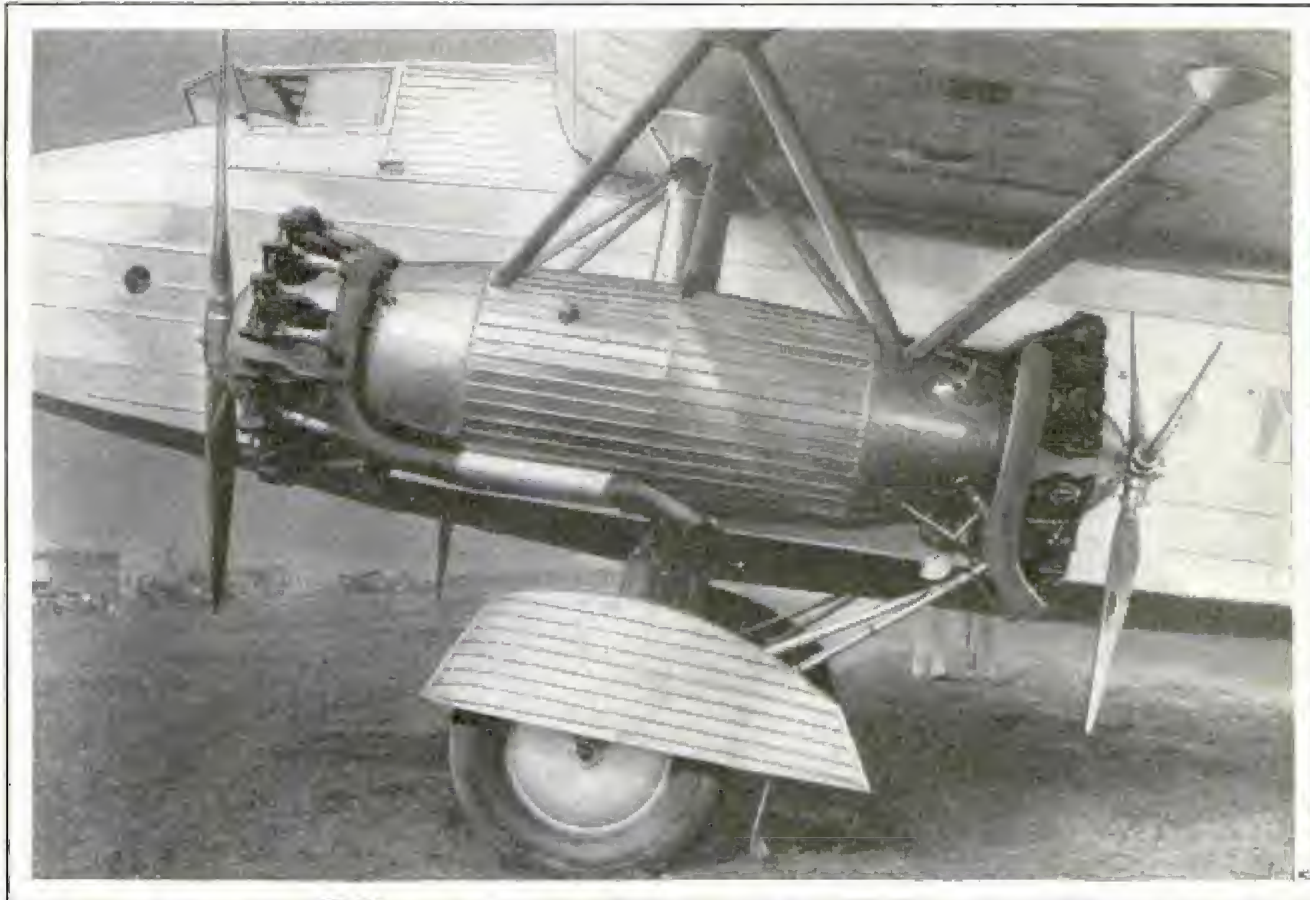


Combination Airplane Seat and Parachute, Used to Land Passengers in Case of Danger

N.E. Utility News
N.E. Postal Push Service

Switlik Mfg Co.
1310 E. 1st St.

LARGER AIRPLANES PROMISE LOWER FLYING FARES



Tandem Motors of the Thirty-Two-Passenger Fokker Monoplaner Built for the Universal Air Lines; Note the Two-Bladed Metal Propeller in Front and the Three-Bladed Adjustable Propeller in the Rear

Reductions in passenger rates on air lines are seen as a result of planes with larger capacity and consequent greater earning power, such as the thirty-two-passenger Fokker monoplaner recently completed for the Universal Air Lines. In the opinion of William P. MacCracken, former assistant secretary of commerce for aeronautics, such planes probably can be operated at a lower expense per passenger-mile. Anthony H. G. Fokker, designer and builder of the big plane, which is equipped with berths so that sixteen passengers can be accommodated on night journeys, also believes that lower rates are assured in the near future. The latest Fokker plane has tandem motors of 525 horsepower each. There are two engines on each side. The front propellers are of metal, are adjustable and have two blades, while those in the rear have three blades to afford a better "bite" in the blast from the front "props." The ship has a wing span of ninety-nine feet, carries a crew consisting of two pilots, radio operator and steward. On a test flight, it made 157

miles an hour air speed. Assuming such large planes can be operated at \$1.50 per mile, which Mr. MacCracken regarded as not improbable, and that the average number of passengers carried is twenty-five, the cost per mile would be six cents. Could the operators of thirty-two-passenger planes procure full loads, the operating cost on this basis would be less than five cents per passenger-mile, he stated. Indeed, with planes of larger than thirty-two-passenger capacity, rates as low as those on trains are not impossible, especially if cost of Pullman accommodations is added, he asserted.

WHITE FINISH FOR ALUMINUM

Aluminum, naturally a dull gray, may be given a dead-white finish by a simple and inexpensive process reported to the American Electrochemical society. The metal is boiled in milk of lime to which a little calcium sulphate has been added. This coating is being tested as a base on which to apply paints and enamels.

*Fokker Aircraft Corporation of America
110 E. 42nd St. New York*

3347

Ch. J. Cunningham

Great Lakes dredge & dock Co
 104 S. Michigan
 Chicago
 1590 HUGE DREDGE TURNS WATER OF LAKE INTO LAND



The "New Jersey" Filling in a Section of Chicago's Lake Shore for Frontage Improvements; Water and Sand Are Pouring from the Big Outlet Pipe, Forced from the Dredge in the Distance



Closer View, Showing the "Spuds" or Feet by Which the Dredge Is Anchored and Moved Forward; at Left, the Revolving Cutter of Special Steel; It Loosens the Material for Passage through the Outlet Pipe; the Dredge Required the Construction of a Special Tug for Towing It

PALATIAL DREDGE "WALKS" ON EIGHTY-TON FEET

The dredge "New Jersey," recently constructed for use along the great lakes, at a cost, with its equipment, of approximately \$2,000,000, has luxuries usually found only on passenger vessels. It has been described as the "largest and most expensive contractors' tool ever built." It is of the cutter type, that is, it has a huge revolving blade of vanadium-steel alloy to loosen the material under the water so that it can be discharged in semi-liquid form to the point desired through big pipe lines. The intake, thirty-four inches in diameter, is in the center of the cutter. As the big blade, driven by a 600-horsepower motor, whirls, sand, clay and small gravel are sucked up by a 3,000-horsepower pump and sent through the pipes. A thirty-inch stream can be forced a distance of 10,000 feet. The "New Jersey" has two spuds, weighing eighty tons each, as feet on which it "walks" forward as the work proceeds. One spud is lowered at a time to form a pivot on which the dredge turns. When it is necessary to move, this spud is hoisted and the opposite one lowered. Electric current for operating the machinery is generated through four Diesel engines of 5,000 combined horsepower. If used for lighting alone, the plant would furnish electricity sufficient to illuminate a city the size of Albany, N. Y. There are fifty-seven motors in all. A crew of from forty to fifty-two men, worked in three shifts when conditions demand, are housed in comfortable quarters, attractively finished in plywood and fitted with electric fans, shower and bathrooms, a social room, large dining hall, a laundry and modern kitchen with an oil-burning range. The dredge has its own telephone system for communication throughout the craft and to the end of the pipe line, which may be more than a mile away and therefore obscured by fogs. The "brains" of the dredge are in the forward control room, overlooking the cutter and the gauge that shows the depth of the excavation being made. Here, the operator manipulates the controllers that govern the speed of the cutter and the pump and watches the instruments that show how the machinery is functioning.



Sketching from the Jointed Wooden Model of Human Form Adaptable to Many Different Poses

JOINTED MODEL FOR ARTISTS TAKES MANY POSES

As a substitute for a live model, a jointed wooden figure, with arms, legs and torso that may be arranged in many poses has been introduced for artists. It is accurately shaped as to scale and proportions, easily manipulated and, when not in use, may be taken apart and stored in small space.

BOTTLE OPENER ON PENCIL TIP FITS IN VEST POCKET

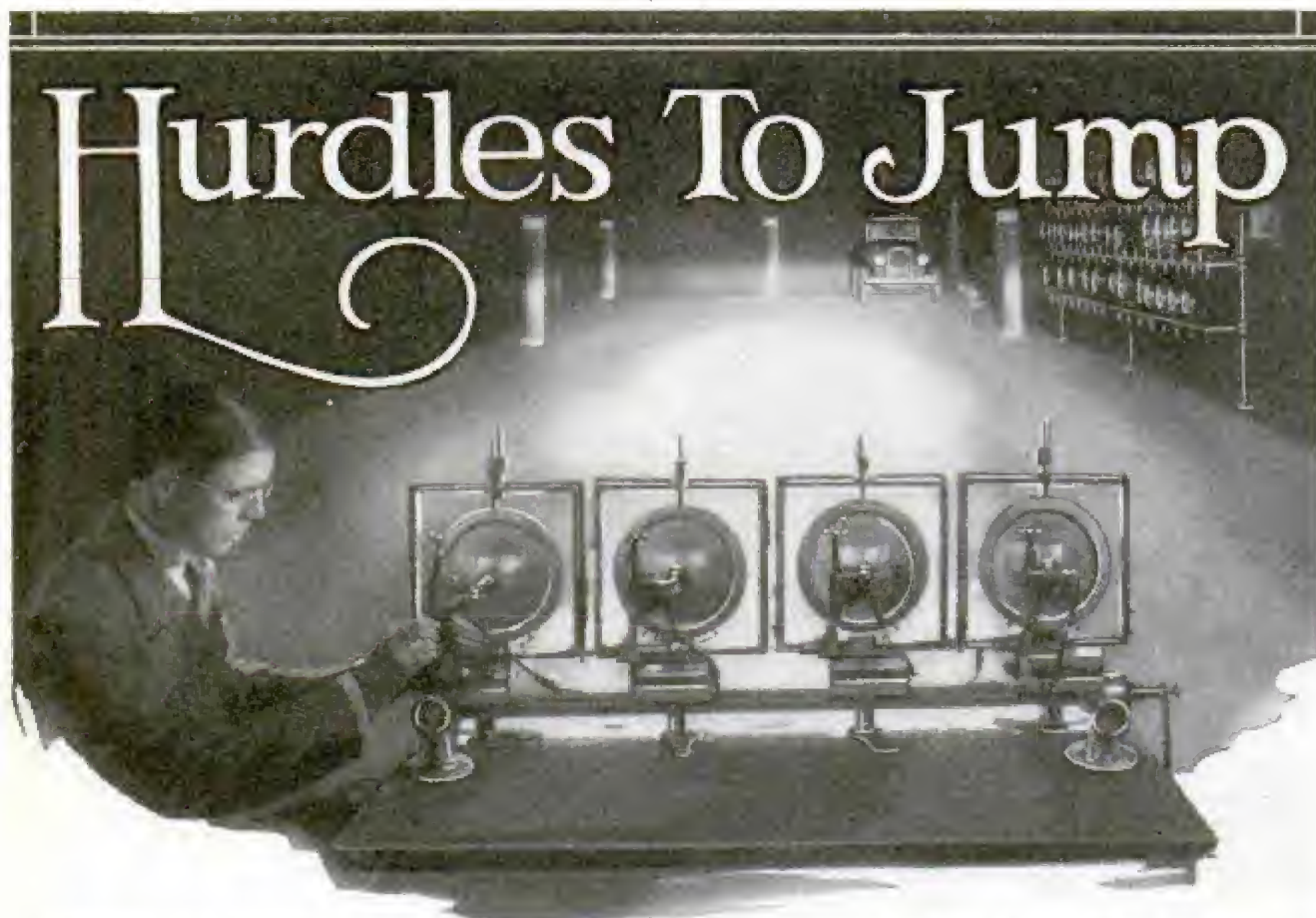
Pencil and bottle opener are combined into one handy instrument that is now on the market. The opener fits over the end of the pencil so that both may be carried in the vest pocket, the two occupying no more space than the ordinary lead pencil.



As high as the tallest modern automobile, and with a "wheelbase" of about 140 inches, the skeleton of a prehistoric hog has been mounted at the University of Nebraska.

*Opener and Pencil Co.
Cedar Rapids, Iowa*

332
The J. C. General Motors Research Lab.
Detroit, Mich.



Headlamps Are among the Automobile Accessories to Receive Thorough Tests; Here Are Shown Some of the Lights Being Tested to Determine Their Point of Highest Efficiency

By C. F. KETTERING

Inventor of the Automobile Self-Starter and Head of the General Motors Research Laboratories

THE WORLD is eager for new ideas. The field of invention has no boundaries. Everyone is curious about something new and will buy it if he can. And the better it is, the longer he will keep buying it. Industry awaits each new device that is technically sound, can be produced economically and sold.

During the past three years, over 35,000 inventions have been brought to the attention of one group of business men. Only a small number survived. Only these few fulfilled the threefold conditions—technical, production and sales. Therefore, something is wrong somewhere with the way people invent.

It is not only a matter of disappointment and punctured ambitions; it is an unjustifiable economic waste of money and labor, particularly the latter. And the waste does not make half so much difference to anyone as to the inventor himself.

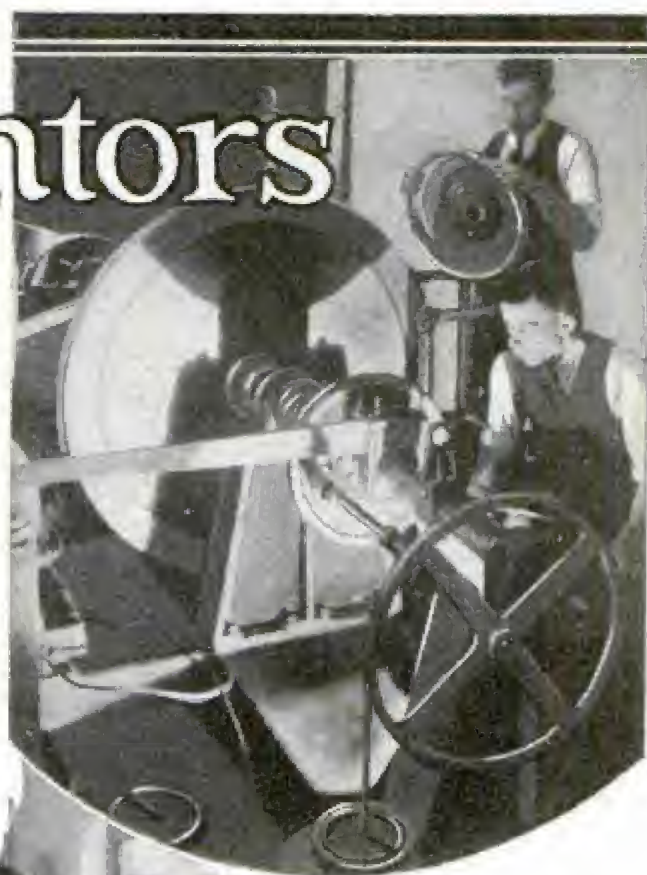
Admittedly these statements are harsh. They immediately put many persons on

the defensive who will argue that what was true of 35,000 inventions does not hold for all inventions, or in all arts and industries, and that the particular group of business men does not represent industry as a whole. People will resent the implication that the inventor is at fault. These arguments and others would deserve careful consideration if it were the purpose at present to defend inventors. But success takes care of itself. Faults in inventing are the things to look for. Trouble, honestly faced, is the beginning of progress; and the rejection of thirty-odd thousand devices is trouble enough to start with. Instead of trying to determine whether the business men were right in rejecting the devices, why not find out exactly what the attitude of business really is with regard to inventions? Why not find out some of the things that the inventor must do if he is to be successful in the business of inventing?

Frankly, business is always on the lookout for good new devices. The manufac-

For Inventors

turer wants them as sources of profit. He recognizes that everyone is becoming more and more mechanically minded. Washing machines and ironers, vacuum cleaners, automatic refrigerators, sewing machines, with all their latest improvements, are making the wives engineers as well as housewives. Radios, automobiles, talking machines, talking movies and a numberless list of everyday utilities are all business enterprises. All depended in the beginning on new ideas and devices.



Above, Testing a Set of Brakes under the Same Conditions as When They Are in Actual Use on a Car; Below, a Conference of Scientists and Inventors

But there are no park benches in progressive business. No industry can remain permanently successful by sitting complacently on any invention, however good. While a fortunate invention or discovery may have started a concern, only brains and dissatisfaction can keep it going. The men at the head of a concern must be eternally dissatisfied with their own products and must be eternally doing something about it—everlastingly on guard to find ways and means to improve and develop. This healthful policy of being dissatisfied and doing something about it operates in nearly all industries. It was behind the automobile in every stage of its advancement: self-starting,

dual-beam headlights, time-payment financing, nitrocellulose lacquers, and so on. The very same policy has transformed the wireless telegraph into the very latest alternating-current radio set. And while bringing about these greater values and enjoyments to the people who buy, it has also produced profits to the manufacturers

with brains enough to be dissatisfied, and profits to those who helped the manufacturers to progress.

Some of those who help must search for new devices, methods and principles. Others must develop designs and production methods. Still others have the field of distribution and merchandising. No one in an organization is responsible for progress to the exclusion of his colleagues. Sometimes the engineer or inventor who holds the patent, claims the entire credit. But in ninety-nine cases out of a hundred, a device would be utterly useless were it not for the production man, the accountant, the financier and the salesman.

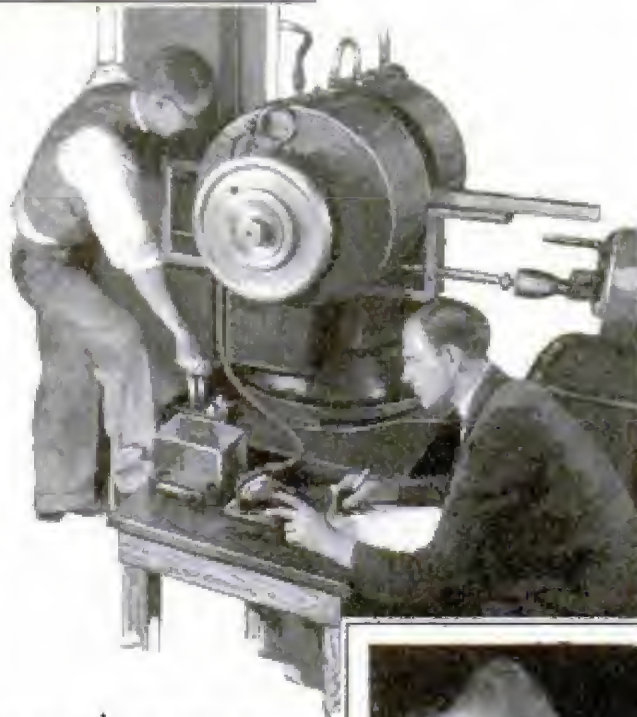


Of course, there is no question of the importance of the engineer. He is the man who is hired to look for the troubles in a product and remedy them. He is a professional fault finder and fixer. His stock in trade are intelligent imagination, clear thinking, accurate explanation, careful observation and definite recording of facts. If, in addition to these, he has a fair share of business acumen and a pretty big share of common sense, he ought to be a good engineer or almost anything else. Business men have come to appreciate the commercial value, in dollars of profit, accruing from men with these characteristics. They are being put more and more on the company payroll as consulting engineers, research engineers, metallurgists, chemists, physicists, and what not. They are very seldom, if ever, called inventors. But, in a way, they must be, for it is their job to find remedies in concrete designs and materials. For example, engineers invented the harmonic balancer, orthophonic victrolas and the bimetallic disk for electric irons. When engineers are on the com-

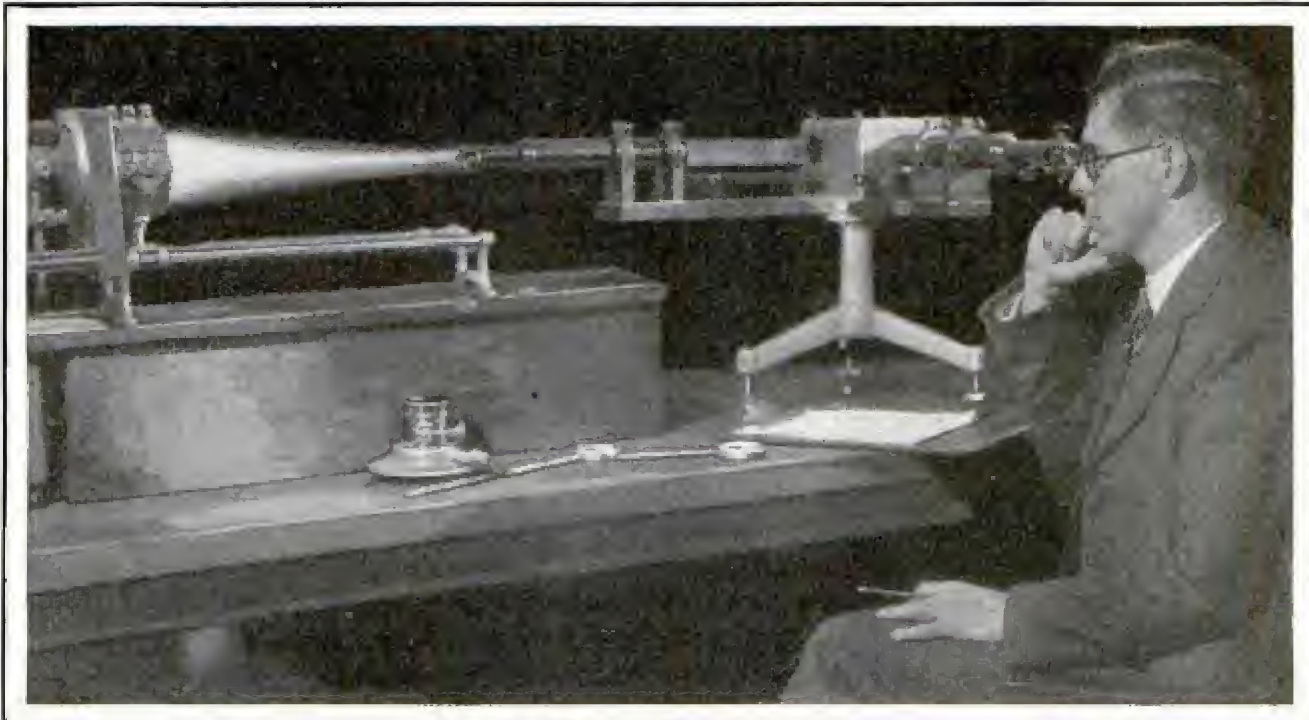
pany payroll, they are expected to apply their talents to the solution of a definite problem which has, or is thought to have, a definite relation to the company's profits. This connection may be obvious, as in tracing down the cause of breakage in a spring leaf, or it may be obscure, as in measuring the surges in a condenser.

Then, too, the engineer must be orderly and make constructive progress in his work. He is spending the company's money, not his own; and normally a company is not in business to make experiments but to make money. No engineer on the payroll can invent in red ink. Engineering is a combination of brains and material. The greater the brains, the less

the material and the less the cost. This does not mean that inventors outside of an industry cannot have a definite purpose in their work, cannot have a commercial point of view and cannot appreciate economy; quite the contrary, many inventors are just as orderly and just as businesslike as any engineer. Con-



Top, Sound Tests to Eliminate Car Noises; Center, Magnet to Test Defective Steel; Bottom, Studying Knock in a One-Lunger



Detecting Impurities in Metals with the Spectroscope, Which Separates Light from Hot Metallic Vapors into Component Colors Just as the Raindrops Separate Colors to Form the Rainbow

versely, many company engineers are neither. But this much is true: Definiteness of purpose and an appreciation of the commercial situation involved constitute the most rigid base of understanding between the men on a company payroll and those on the outside. This is particularly true if the latter have something to sell.

However many engineers or inventors a company has on its payroll; however much in equipment and laboratories, it can never hope to think of all the improvements for its own products. Good ideas and devices are bound to originate on the outside. The race of good inventions is open for all. But it is a hurdle race. Attempts to run around or ignore two or three hurdles account for nearly all failures in inventing. So advice to inventors can be reduced to just this: Do not run around these hurdles; jump over if you can. Be aware that in many lines of endeavor invention has largely passed away from the single inventor working by himself and is now to be expected from a group of individuals working closely together. In General Motors research laboratories, for instance, much inventive engineering is being applied to the power plant of automobiles. No one is trying to do the thing by himself. One is investigating valves and camshafts, another

pistons; another combustion chambers; another carburetors and manifolds; another the atomic structure of fuel, and another is inventing instruments which will reveal the pressure changes that take place in a combustion chamber. But the significant fact is that each recognizes his dependence on the others for the complete success of his own work. The engineer will not be successful in a combustion-chamber study unless he takes full advantage of all that the fuel-research engineer has to give him, and vice versa. The inventions and discoveries of the individual are largely due to co-operation.

Of course, it is not always possible to work with others in the growth of one's own ideas. Nevertheless, co-operation remains as an ideal limit. Wise inventors are taking every advantage of what others have to contribute to their own ideas.

Familiarize yourself with the commercial development in the art. As pointed out above, business is aggressive in finding and trying new ideas. It has tried thousands of things that would be beneficial if they would work, but, as a matter of fact, do not work or cannot be produced economically or sold. So it seems useless for an inventor to go ahead with these same old ideas without finding out, first, why business rejected the ideas; second, if the causes of the previous rejection still

operate. The chances are that many inventors never even take the trouble to find out if their idea has been tried. They too often spend their own time and money first only to meet disappointment later.

Familiarize yourself with previous work in the art. Mighty few startle the world with a completely new mechanism. Most inventions are only the development of some device or process already well-known. Nearly every development has a long history to which each inventor contributes a little. It will save the inventor a great deal if he first investigates this history. Possibly the very same ideas he has in mind have already been thought of, adopted and then discarded for a better plan. This may be disheartening, but inventing is serious business and must rely on facts, not fancies.

If an inventor has determined exactly the previous commercial and technical history of his device, made up his mind to use the experience of others as a working tool and then feels that his device is still worth something, he has jumped the highest hurdles. A few low ones remain.

Keep detailed notes of your daily efforts. It would be unwise to make any general statement here on legal matters but at General Motors, from the legal point of view alone, every research engineer is required to keep daily memoranda of his ideas, conversations, plans, tests and efforts relating to his work. These notes are signed and dated every day. They are witnessed and filed away in the vault as an undeniable evidence of diligent and consistent work. They are a record of what the engineer set out to do, how he proceeded, what his difficulties were and his plans to overcome them. With these things in mind, he is in a position to carry out orderly, purposeful and successful research and inventive thinking.

Be on guard to simplify your device. Generally speaking, simplicity means reduced costs, ease in manufacturing, quick understanding on the part of customers and greater satisfaction in their service. To a large extent, successful invention reduces the complexity of a mechanism or decreases the mental anxiety of the operator. Since these things determine the life or death of a device, an inventor will do well to simplify his device. If it weighs

ten pounds, try to make it equally strong at six. If it has forty parts, try to make it operate better with only twenty-three.

Look at your device as a problem of science. Pretty much without exception, devices are all problems in physics and chemistry. The chemical formulas are the language of the inventor who looks at his device in fundamentals. The concepts of the science may appear technical, but inventing is technical business. The greater danger is that the laws of science are considered too superficially simple, whereas they demand precise and clear thinking. For example, take the case of the inventor of a battery that apparently produces more electrical energy than does an ordinary battery. Very frequently the output of such a battery is remarkable for a few hours and then the battery fails. The trouble very likely is that the inventor did not look at his battery as a problem in chemistry. He knew that if he put in two metals with an electrolyte between, he could get an electric current. He did so and took the first step in making a remarkable battery. But he did not go far enough. He failed to see the chemistry in the reaction of metals with acids. That is why his battery failed: The electrolyte corroded the plates.

Subject your device to tests and obtain quantitative measurements of its performance. Even if this battery inventor had been no chemist, still, with an open mind, he should have discovered that something was wrong with his battery. If he had put it to honest test, time would have shown him. The test is the thing.

It is the easiest thing in the world to conduct a test to prove anything you want, if at the outset you are convinced that your device is all right. But it is unquestionably better to find the facts regardless of their consequences. This may require a great deal of careful study, for often the test is more than half the problem of inventing something. But test or no test on the part of the inventor, the test is coming just as sure as taxes, as the manufacturer undoubtedly will test the device before he agrees to buy it.

When the public buys it, they will test it. They will use it under all sorts of conditions. If it doesn't stand up, they will not continue to buy. The chief trouble with

letting the public do the testing is this: When the public makes its report on the device, if the report is bad, the inventor is powerless to do anything about it.

It is a great deal better for the inventor to do his own testing. About the only equipment he needs to start with is a state of mind that is forever open. And the test should disclose how the device performs.

Be rather pessimistic of your own achievements. Imagination is what sees possibilities for improvement. Watt's imagination at his mother's teakettle saw the steam engine. Then he went ahead and built an engine which worked. His was a working imagination; another kind is a wishbone imagination. Inventors with a wishbone imagination see a valuable improvement and wish it were accomplished. They wish so hard, they finally imagine they have brought it about.

Years and years ago people invented flying machines by the wishbone method. The Wright Brothers used the working method. Possibly a little hard pessimism about your own ideas and achievements will be fairly sure to make your imagination work to some useful end. If not, it will at least save much embarrassment.

Realize that a device must be adaptable for production if intended for general use. This hurdle is just common sense. Any inventor who honestly tests his invention and is somewhat pessimistic will jump this hurdle naturally. After all, inventing is just one phase of industry, and inventors must have as much commercial sense as inventive genius.

Focus your effort on the problem and not entirely on your device which you think solves the problem. This is just common sense also. Unfortunately a great many inventors are heart and soul in their device and never find out that the



Determining Exact Carburetor Performance by Placing It in a Mercury-Sealed Box and Observing Data from Instruments

device does not come within a gun shot of helping the situation. But these are not the wise inventors.

Select a reliable patent attorney. When the manufacturer is interested and the public wants the device, the only equity the inventor has is patent claims. The lawyer is probably the only man who can write patent claims. So the only thing the inventor can do is to be mighty sure that the lawyer is worthy of this great responsibility and trust.

It is difficult to sell an undeveloped idea. Edison could not sell the idea of electric lights but he could and did sell the lights. An inventor can sell his services or he can manufacture and sell a product or patents or rights under patents. But he can rarely sell an idea. Inventors often approach business with "a big idea" and ask for a large sum of money. It would be more to their interest and better business practice to offer a drawing or sketch or description duly protected.

These are some of the hurdles. There may be others. If you find any more, jump over them.



Chair Fitted to an Airplane for the Convenience of Parachute Jumper or Stunt Performer

CHAIR ON TOP OF PLANE WING FOR JUMPER OR STUNTER

For the convenience of the person engaged in parachute jumping or performing stunts from an airplane, a French inventor has devised a special chair. It is of metal and securely braced to the top of the wing of a biplane, just above the pilot's seat. This gives the jumper immediate and easy access to either wings or fuselage.

CROOKED HOOK HELPS LAND FIGHTING FISH

Combining lever and corkscrew action when a pull is exerted, a fish hook with a crooked shaft has been made, to enable the easier landing of game fish. The hook



also allows the bait to revolve in the water, simulating life. The shaft is bent almost at right angles about an inch below the eye, and the hook likewise is curved outward from the shaft much more sharply than the

ordinary hook. A pull exerted at the eye causes the hook to turn much like a corkscrew in reverse action, and at the same time gives leverage. It may be used with or without a barb and is easily removed when the catch is landed.

LUMINOUS FLY PAPER CATCHES INSECTS AT NIGHT

Luminous fly paper that lures light-loving insects to a sticky doom, at night as well as in the daytime, has been produced by combining phosphorescent pigments with the coating which shines when the paper is in the dark. Phosphorescent materials also are being used for signboards, house numbers and on life buoys to make them visible in the dark.

TINY ELECTRIC WATER HEATER CARRIED IN POCKET

Heating water where the usual facilities are unavailable is simplified with a small electric outfit which is so compact that it may be carried easily in a pocket or traveling bag.

The heater operates quickly, as it is placed directly into the water. It is constructed of aluminum, and the manufacturers claim there are no parts to get out of order.



SHAVE CATHEDRAL WINDOWS

Safety-razor blades have been used to save the priceless fourteenth-century stained-glass windows of Somerset cathedral in England from what seemed irretrievable ruin. After exhaustive chemical and microscopic examinations, experts decided that the windows, as befitted their age, were growing chemical whiskers, and they were saved by being literally shaved with ordinary safety razors. Sulphuric acid fumes from gas lamps combined with dust from the stone with which the cathedral is paved caused the incrustation on the stained glass.

Dr. Alexander Scott

HIGHWAY SIGNS GUIDE PILOTS

Marking of highways to guide airplanes has been undertaken under supervision of the aeronautics division of the department of commerce.

The plan provides for marking all federal and state highways in characters of ten to thirty feet in height in yellow or white traffic paint. The markers show the route number and the "U. S." or state abbreviation. A highway, viewed from the air, stands out clearly and is one of the pilot's best landmarks if he knows what road it is. The markers would appear at intervals of from ten to twenty miles and at road intersections.

MOTORCYCLE RUNS CANDY CART AT SMALL EXPENSE

Combining a secondhand motorcycle and an old pair of automobile wheels, a Santa Monica, Calif., cripple has constructed a motorized candy cart to supply tobacco and sweets to anglers on the Santa Monica pier. The motorcycle pro-



A Motorcycle Furnishes Motive Power for This Candy Cart, Mounted on Old Auto Wheels

vides sufficient power to move the portable store from place to place along the beach and cost less than \$300.



© P. & A.

One of the Classroom Coaches of a German School Train Where Road Employees Learn the Theory and Practice of Railroading

SCHOOLS ON WHEELS TO HELP TRAIN RAIL WORKERS

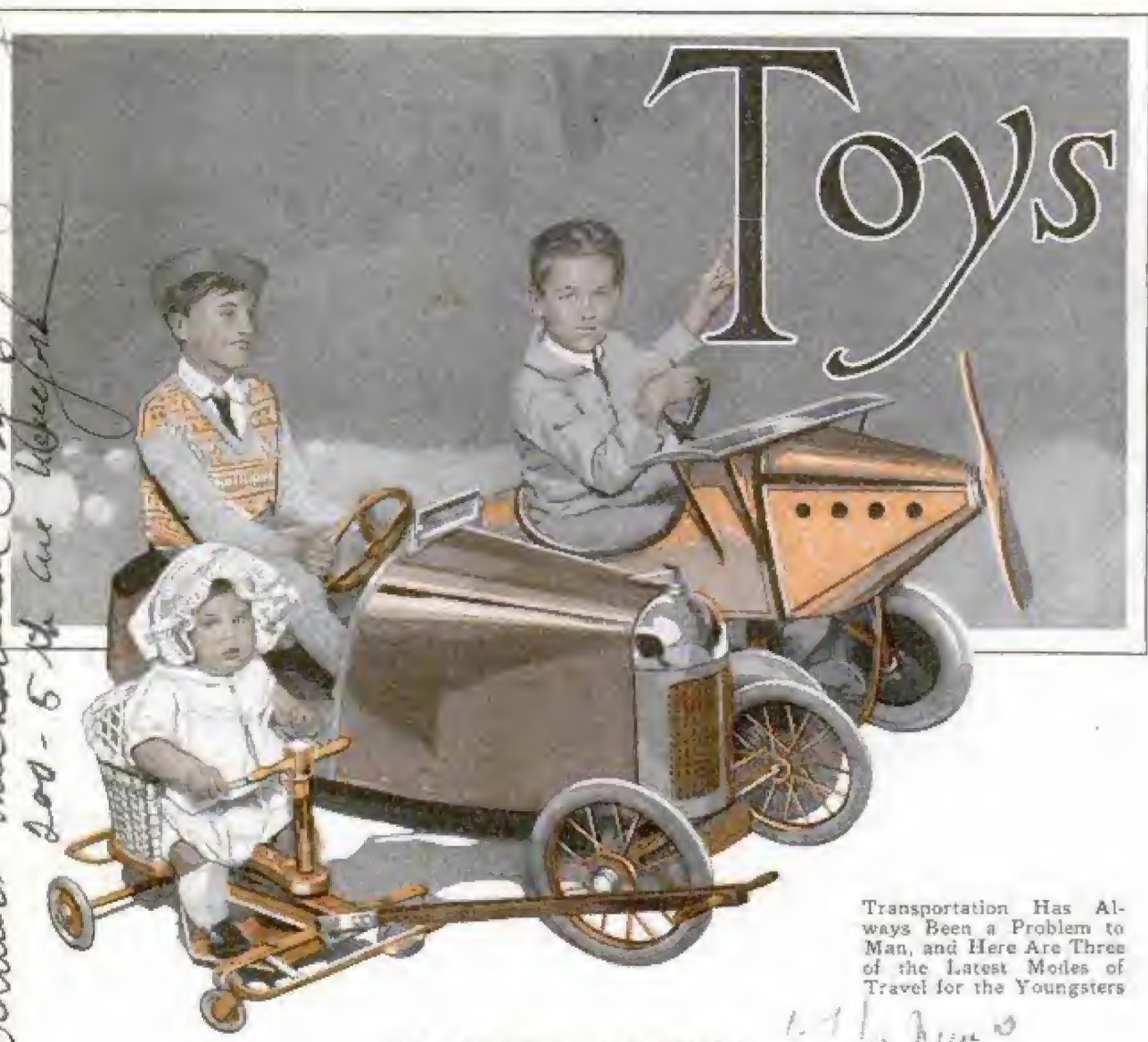
Traveling "school trains" have been organized by the German government, which operates the railroad, to teach employees the theory and practice of the business. The road has equipped a number of passenger coaches as classrooms, each in charge of an instructor. These cars move from place to place, classes being held at each stop, where employees, without loss of much time, are given instruction in the operation of trains. The cars have all necessary demonstration equipment.

HEALTH JUDGED BY EYELASHES

Long eyelashes, generally considered a mark of beauty, have been found by a Japanese physician to be a sign of ill health in many cases. After a two-year study, the doctor came to the conclusion that most children in poor health have long eyelashes. He found the lashes of consumptive children grow twice as long as those of children that are in good health. The lashes of the latter grow about an eighth of an inch the first year of life, while those of scrofula sufferers grow twice as long. No explanation of the condition has been offered, nor has it been accepted as a definite criterion of the state of a child's health.

Reference to influence of environment

*Revised traces, due, 275 North Ave
not in 1st 12/20/37
Strauss mechanical Toy Co
200-5th Ave New York*



Toys

Transportation Has Always Been a Problem to Man, and Here Are Three of the Latest Modes of Travel for the Youngsters

By ALFRED ALBELLI

VERY often the careers of great men in various scientific fields have found their first inspiration, according to Ferdinand Strauss, head of a large toy factory, in the playthings which amused and fascinated them in childhood.

He goes so far as to assert that there is no inventor who cannot recall the influence, slight and subtle as it might have been, which tinkering with toys has had on his bent to inquire into what composes their mechanical elements, and in eventually shaping his life's course.

"Many a youngster," said Mr. Strauss, "is started early on a career through the encouragement he receives as he takes his first toy apart to see how it works, and then tries to put it together again.

"The desire to know what a toy is made of and why, what it is supposed to do and how it does it, teaches the child many things. History is full of examples of

men who received the incentive for their future life work from their playthings.

"Everyone knows that Thomas A. Edison spent all of his playing time with tools. Neither did the Wright brothers invent the airplane by accident. During their childhood days they continuously played with balloons. They would inflate different-sized balloons and float them at various heights to observe how the wind blew them and see which floated highest.

"Carl F. Akeley, the inventor and big-game hunter, also spent his play hours as a boy with various types of small implements. The gift of a folding pocket foot-rule, he has told me, gave him a big thrill, and with his tools he made toys and useful articles for the house. In later years, during his famous exploits in the jungle, hundreds of miles from any source of supplies, this ability of construction stood him in good stead. His fun with a tool chest

Make the Man

as a boy now turned to great practical worth in facing the crises of travel and shelter.

"Another great man in whom the influence of toys is traceable is Dr. George Ellery Hale, of the Mount Wilson observatory. He is one of the world's foremost astronomers. Among his favorite toys were engines, yachts, and other machines that afforded opportunity for mechanical construction.



The Advance in Aeronautics within the Last Few Years Has Made Its Effect Felt in Toyland, and the Ingenious Models and Toy Airplanes Have Proved a Source of Almost as Much Amusement to Grown-Ups as to Children; at the Right, an Airplane Model That Appears to Have Caught the Fancy of Someone Long Since Removed from Childhood: Below, a Little Girl and Her Family of Forty Dolls. Including Almost Every Kind, from the Sawdust-Filled Rag One to the Dainty China Dolls That Talk and Cry and Walk

Averell Buff Co
New York

2830 964

POPULAR MECHANICS

Madame Henriette Holtz



"When he was ten years old, his father gave him a tool chest, and this became the nucleus of a small workshop that he built eight years later. He had a lathe, a scroll-saw, a microscope, a camera, a telescope and other apparatus with which he equipped a small laboratory. There he began to design simple physical and astronomical instruments. Doctor Hale still uses some of the 'toys' of his boyhood.

"And there is Rear Admiral Wm. A. Moffett, the chief of the bureau of aeronautics, U. S. N., who has told me that, as a boy, he was most interested in flying kites. I would go so far as to wager that if Lindenthal and Modjeski, the great

Above, the Manufacture of Dolls in a Toy Factory, and, Below, Inmate of an Old Men's Home at Work on Christmas Toys

Phila

bridge builders, were to tell you of their childhood, you would learn that as boys they spent a great deal of their time making toy bridges.

"Toy making has its own peculiar psychology. Toys should be a diminutive duplication of the instruments of man. For instance, a child hears of the Zeppelin. There is a link between his imagination and reality which I try to transplant in the miniature toy Zeppelin which I invent for his pleasure. I try to incorporate into the toy the principles by which the genuine article operates. Then the toy not only amuses the child, but also teaches the fundamentals involved.

"Another thing—the toys must have durability. They must be able to stand the use and abuse that children necessarily give them. A doll should not lose its stuffing when it falls to the floor, nor should a mechanical toy cease and desist, as we say, after the fifth winding. If the child is disappointed in the toy, he will not think much of the article it imitates.

"For many years, mechanical toys have been the favorite playthings, and in a comparatively short span of time they have shifted from foreign factories to America, where they are the foundation of an established industry. About eighty per cent of the mechanical toys sold in America are of American make. These go into hun-

dreds of thousands of homes, and the volume of business runs well into millions of dollars.

"All through my toy-business career I have tried to impress my workmen and my customers that toys are not only bought for emotional reasons, as when little Mary's birthday rolls around, or because Johnny is a good boy.

"I have tried arduously to show that the appeal of toys was more profound than is readily thought; that the child has a vivid imagination, that he is in the formative stage and that impressions he gets from playing and experimenting with his playthings will do much to mold his future. Quite often it creates the spark of what later becomes mechanical or creative genius.

"Lastly, there is the commercial aspect, too, which is very vital. Most children have a superiority complex. Toys, like autos, trolley cars and derricks, which enable them to operate these in a manner they believe similar to the manipulations of the real thing by their elders, create in them a feeling of superiority. Children also yearn to play with miniature reproductions of objects which score popularity with the general public."

Zeppelins with two propellers that revolve when the ship is pulled along the floor, are among the "newest" toys this



"Dismal Desmond" Is the Latest Addition to the Soft Toy-Dog Family, and Here Is a Little Devotee of the Desmond Family with Quite an Assortment of the Sober Puppies

George Borgfeldt & Sons

Knapp Electric Co 200-5 H Ave
 New York



Above, Santa Claus' Automobile Fleet for Good Little Boys; Left, "Pyramids," One of the Games of Skill

season, R. C. Gibson of Marshall Field and company, pointed out, declaring that since the child's world is a "minature edition" of that of the adult in many respects, it is only natural to have the youngsters intensely interested in what concerns their parents, especially when that interest is represented in an effective way as in a toy. For the same reason, model airplanes and other toy aircraft of a wide variety are sweeping the stores just as aviation is claiming the nation's interest.

"Mechanical toys that simply run have comparatively little appeal these days," said Mr. Gibson, explaining the decreased interest in climbing monkeys and other things of that kind. "The toy that is accurately and realistically made and that functions as nearly as possible like the real article wins the child's heart. There

are scarcely any absolutely 'new' toys. Possibly some inventors are overlooking a profitable field in this direction, but, as in other forms of mechanics, a wholly new idea is difficult to originate. However, there are constant improvements over existing ideas."

He demonstrated a mechanical tractor, another new article this year. It is a faithful replica of the endless-tread affair and climbs steep steps and mounts other obstructions with ease. The tread is a large corrugated rubber band, moved by a strong spring motor. Toy dogs are not new, but this year finds the well-stocked store with supplies of realistic models of different breeds of dogs. Children are no longer content with just a toy dog, they want a chow, an airedale or a terrier, and the manufacturers have answered the demand with a remarkable line of animals that have all the markings and colors of the live dogs.

Three-compartment electric stoves with three switches and a thermometer just like the full-sized kitchen cookers, sets of

toy dishes with electric percolators that actually operate, and tiny sets of furniture closely modeled in style and color after the modern ideas are available for the little girls, and, although their interest in dolls has not waned, they demand better-dressed ones and sets of clothing that can be laundered. Toy merchants declare the model planes and other aircraft, as well as many forms of mechanical toys designed expressly for boys, are just as popular among the girls, but the boys are rarely willing to play with girls' toys.

COLOR-DOTTED GOLF BALL IS EASIER TO FIND

Golf balls on which are marked twelve brightly colored dots now are on the market, to help improve the game and reduce the cost of playing it. The dots make the lost ball easier to find, and the various combinations in which they are arranged simplify identification. In addition, it is claimed they make the pellet look larger and give a better target by providing a point on which to focus the shot.

CATAPULT TO SHOOT LIFE LINE RESEMBLES CANNON

Somewhat resembling a cannon, a catapult to launch a life line has been invented by Santos Dumont, European pioneer in aviation. The catapult, mounted on two wheels, is easily transported and designed



This Apparatus, Which Looks like a Cannon, Is a Catapult That Launches a Life Line

to shoot a line to persons in distress when it is impossible to launch boats to go to their aid.



Projector in Operating Position on Cabinet; It Is Slipped into Rear Compartment When Not in Use; Note Film Racks at End

HOME-MOVIE CABINET HOLDS PROJECTOR AND SCREEN

For showing movies at home, an attractive cabinet that holds the projector, splicing machine, camera and other units, besides a screen and space for storing forty-five 400-foot reels in humidor cans, has been placed on the market. When closed, it forms a convenient desk or stand. An upper hinged panel drops down to form a shelf and to expose the projector, which is easily removed from its compartment and adjusted for running. Plugs for attaching to wall sockets are installed. The shelf provides a convenient base for the projector when pictures are shown and also serves as a working table for editing, splicing, rewinding and title making. At either end of the cabinet are racks for storing the film cans, and there are also compartments for the camera, tripod and title printer. The back of the cabinet is the screen. This is easily removed and mounted at any convenient place in the room. The outfit is adjustable to different heights, weighs but fourteen pounds, and the screen will not wrinkle or buckle, thereby insuring better displays. The entire cabinet rests on concealed casters.

Whenever you find that you wish to know more about any article in this magazine, write our Bureau of Information.



A Portable Rowing Machine, So Compact When Folded That It Fits in a Suitcase

ROWING MACHINE IN SUITCASE IS EASILY CARRIED

So compact and light in weight that it may be carried easily in a suitcase, a portable exercising machine, constructed entirely of aluminum, is on the market. It reproduces the exercise of rowing and has rubber-tired wheels and base, so that it may be used in hotels without disturbing other guests. Being adjustable for tension, it can be adapted to the use of weak or strong persons.

HOUSE OF THE FUTURE IS SEEN IN GLASS BUILDING

Constructed entirely of glass, a building at a recent exposition at



A Possible Hint of Structural Material of the Future Is Given in This Glass House of Modernistic Design Which Attracted Much Attention at a Recent Polish Exposition

Poznan, Poland, excited considerable interest, and possibly gave a hint as to the structural material of the future. The walls and even a tower were built of glass, and triangular effects in the walls gave the structure a futuristic appearance.

ONE LANDING-WHEEL PLANE ACCEPTED BY ARMY

A Loening amphibian with only one landing wheel, mounted in a well in the center of the boat hull's keel, has been accepted by the army after trials. The one-wheel landing gear was patented in 1924 by Grover Loening, and in 1926 the army equipped an old training plane with a single wheel, based on his patents, and made several successful landings, which showed the idea was fundamentally sound. As a result of the tests the army placed an order for one of the planes. The single wheel draws up into the well, which is a water-tight compartment like the center-board well on a yacht. Mr. Loening also has equipped his Moth sport plane with the single wheel, and none of the three ships show any tendency to turn over on the ground. After the ship comes to rest, supports, ending in small rollers, are dropped from the wing tip floats to steady it. In flight, or when making a water landing, two hinged flaps close the well below the wheel. The ship built for the army also has the new Wright typhoon, inverted-V engine

One Park Place.

3524

new york

Engineering Corp.
420 2 31-21
new york

SUBSTITUTES FOR COAL AND OIL TESTED

French scientists, looking to the time when natural supplies of coal and oil will be exhausted, are making experiments with five substitutes to furnish power for mankind. The researches include a plan to tap the thermal energy of the sea by utilizing the difference in temperature of a current such as the Gulf Stream and the surrounding sea; a device, which already has proved its worth, for utilizing the energy of the tides; a method of using the wind; a plan to use the difference in temperature between tropical and arid regions by harnessing the heat of the desert, and a plan to create an artificial fall of water between two neighboring bodies of water of different altitude, such as the Mediterranean and the Dead Sea, the volume entering the lower body equaling the amount of evaporation. Another idea, evolved by a German engineer, includes damming the Mediterranean at the Dardanelles and at the Atlantic end and using the overflow to produce electrical energy and irrigate the Tunisian Sahara. One French scientist is engaged in laying a pipe, 5,000 feet long, into the sea to demonstrate that the thermal energy of the ocean can be made to work, while another experiment involves laying a tube along the incline of the Atlas mountains on the theory that heat rises in columns or cones of energy and that this energy can be canalized in the pipe and transformed into electrical power. One way to tap the energy of the tides has been found by an inventor who has made a water wheel to enable ships to move against the current upon power derived from that current.



Uniformity in Garden Design Is Attained with a Planter Which Prepares the Holes, and a Paper Pattern of the Design

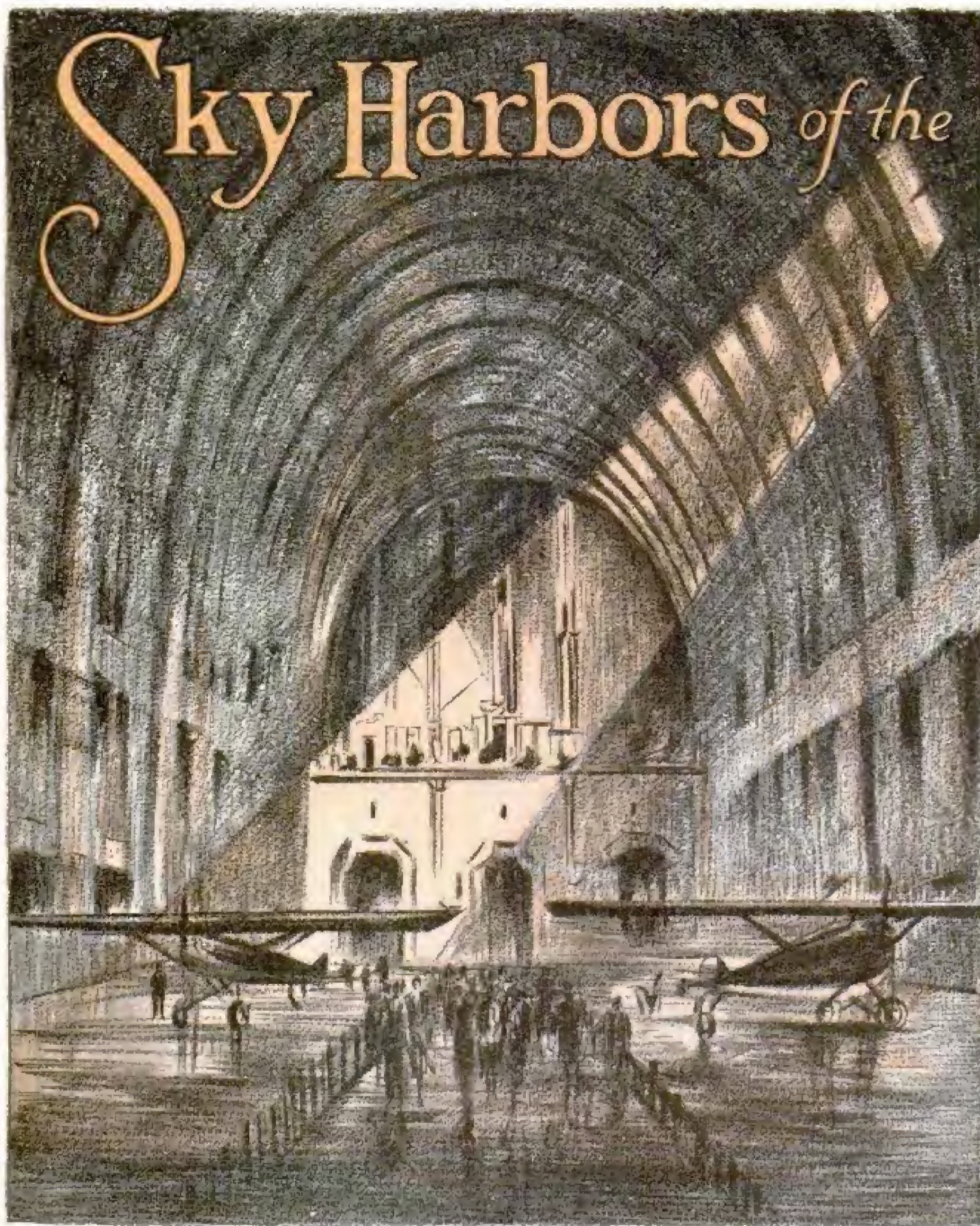
GARDEN TOOL PREPARES HOLE FOR SETTING OUT PLANTS

Setting out plants is simplified by a garden tool which prepares the hole to receive the plant while the operator remains in an upright position. The base of the planter is shaped like an inverted cone and is adjusted to a rod with an axle similar to a brace, which, when revolved in the dirt, makes the required opening. When used for field plants, the hole is made at an angle and may be closed by stepping on the ground. Use of this tool together with designs on paper of various-shaped beds enables uniform planting of flowers in any desired pattern.

☛ Fast-flying birds have stiff, trim feathers.

Ans. Allen S. Logan, 201 Franklin Ave.
Chicago, Ill.

Sky Harbors of the



An Architect's Conception of a Future Airport, Designed like a Railway Terminal, the Planes Being Towed by Electric Truck to a Field Outside after Loading or Unloading

By HAMILTON M. WRIGHT

WITH forty million dollars having been spent on aviation development in the United States during 1929, and with the airplane leaping into popularity more swiftly than did the motor car in its early

days, it is obvious that every city and town in the United States that wishes to keep in step with modern progress is developing its own airport, as the new gateway to the city.



Another Conception of a Future Air-Minded City with Streets Radiating from a Central Airport and Railroad Terminal, 7,500 Feet in Diameter, with Space for Hangars and Hotels

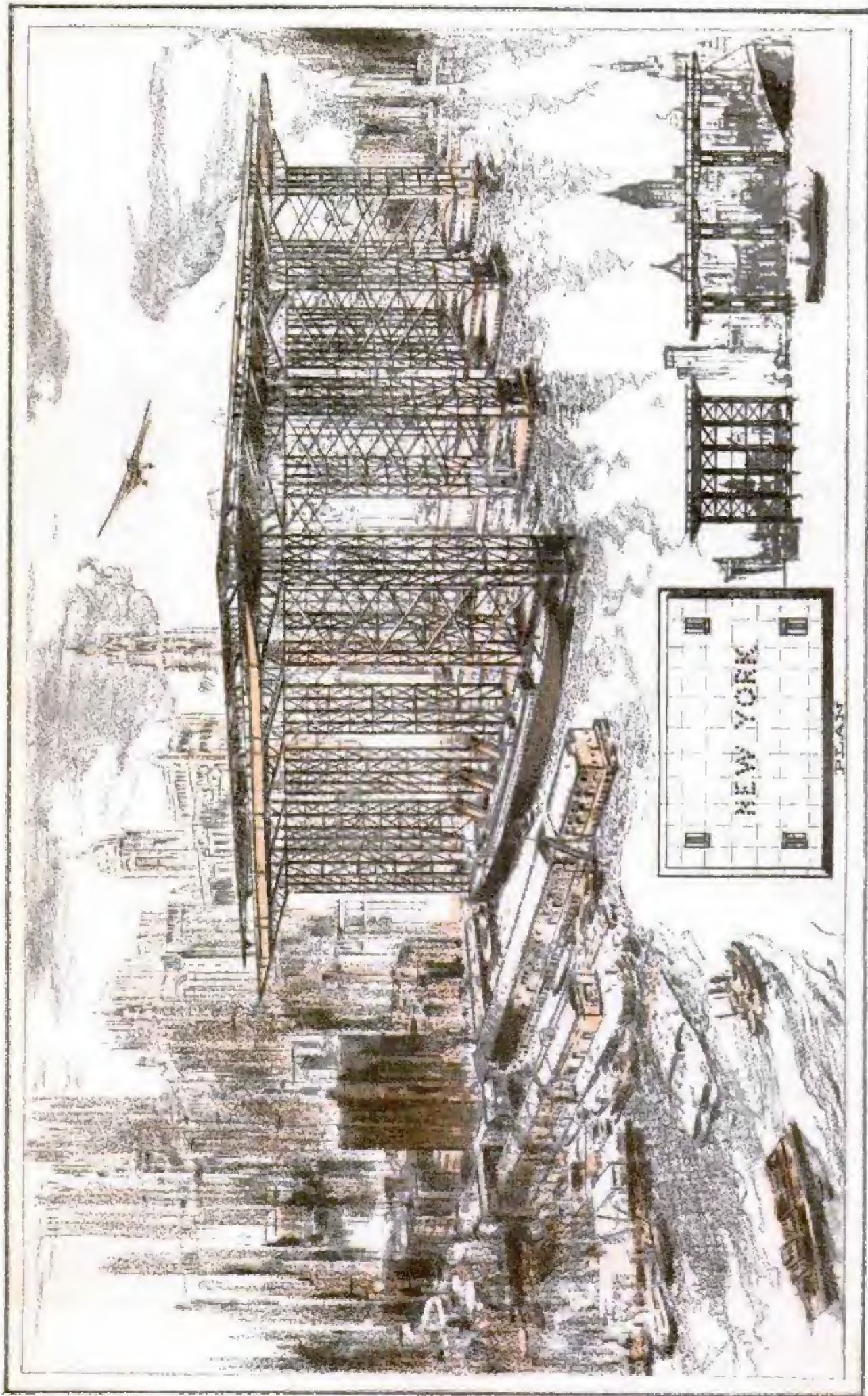
The desirably situated airport is to be regarded as a paying investment not only in the increased prestige and advancement accruing to the community which possesses a modern air field, but in the return from the airport itself. Well located suburban property near a thriving center is almost always sure to grow in value. When the great railroads selected their rights of way, switching yards and terminal locations, the land was given as a bonus by the government or could be bought for a song. It has, since those early days—generally speaking from thirty to eighty years ago—appreciated in value by billions of dollars. Today, aviation, the latest medium of swift transportation, is confronted, similarly, with the necessity of locating its terminals, and while it cannot buy land at the low figures obtained by the railroads, it will save money by acting with vision to provide amply for its future growth. In importance and value, experts believe the larger airports of the future will rank with the great railway terminals of today. Near the smaller cities and towns, airports will be as necessary as the local railway depots. Moreover, since the airport is the key of all commercial aviation, great air-transportation companies in the process of expansion

and of the absorption of smaller rivals will undoubtedly desire to pre-empt and improve the best airport locations.

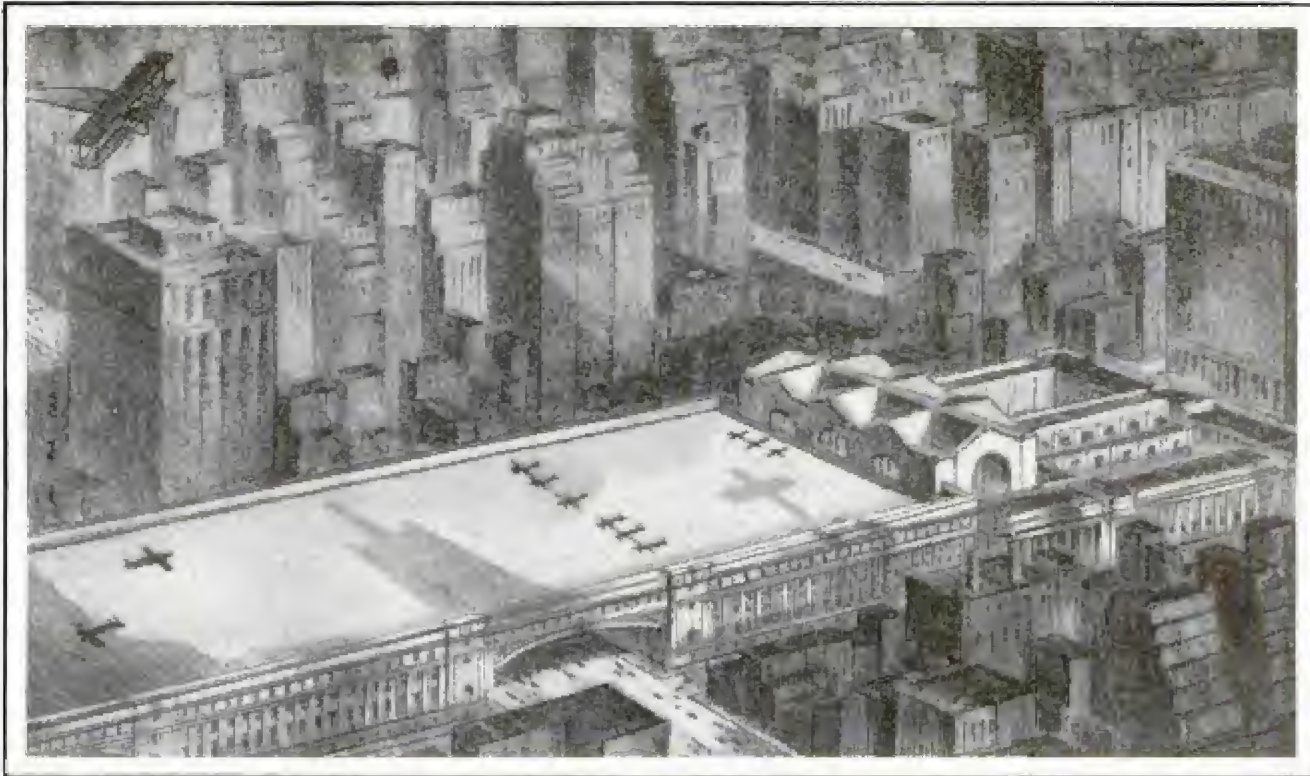
The head of one of the largest real-estate associations in the United States said recently: "Great crowds of people even now visit our airports on Sundays and weekdays to watch flying activities. Since real-estate values follow the crowds, it is easy to see the influence of airports on adjacent land areas.

"The modern airport is becoming a gateway to the city or community it serves. It may be very directly compared to a railroad terminal in its functions, facilities and general character. The airport crowds are in holiday mood, demanding food, care and entertainment. The field personnel, including ground attendants, the administration officials and the pilots, must be housed and fed. All this activity in connection with airports is creating new uses for real estate."

The more immediate sources of profit, however, arise from the airport itself. Like the gasoline filling station and garage, it has definite services and supplies to offer. Among them are the retail sale of gasoline and oil. Rental of hangar space is another item. The average rental is about \$40 per month, ranging from \$15



A Scheme for Utilizing the Space above New York Wharves and Railway Sidings for an Elevated Airport, So Small Planes Could Convey Passengers and Mail Close to the Business Center and to Boats and Railroads and Near-By Airports, Thus Saving Much Valuable Time



An Architect's Idea of How a Landing Field Might Be Built on an Elevated Platform above the Pennsylvania Station in New York; Pneumatic Tubes Would Handle Air Mail from It

to \$30 for a small plane up to \$60 to \$75 for a large one. Repair service, concessions, such as hot-dog stands, restaurants, bowling alleys and rifle galleries, and the rental of parking space for automobiles near the airport are among other profit yielders. The average cost of looking over a plane is about \$2 an hour. Then there are passenger hops above the surrounding country, already an important Sunday and holiday pastime and source of revenue. The publicity manager of a southern resort city instituted bridge parties in the air and afternoon teas in airplanes starting from the municipal airport.

As the number of airports throughout the country increases, cross-country taxi air service will come more and more into vogue as a future source of income. A fifty or hundred-mile hop to the next town will be a money-making trip for the successful salesman, increasing his number of daily calls. The visit of the taxi plane means more servicing and gas and oil and food or refreshments sold to passengers and pilot. The airport, like the successful garage and filling station, must cultivate popularity. Some fields charge from one to three cents per horsepower for every plane that lands. But usually such a plan is bad business, as it keeps planes away.

The first consideration in selecting the

airport site is accessibility. The airport should be located on a main highway but out of the congested area. If, in the case of small towns, it can be reached in, say, fifteen minutes from the commercial center of the town, so much the better. The second consideration is ample area, which is absolutely essential. The field must be large enough to enable planes to land in safety. And third, but also of vital importance, is the nature of the terrain. The field must be level and free from obstructions and have a sufficient number of runways, long and wide enough to make landing safe, no matter from what quarter the wind blows. Of the nearly 1,500 airports now reported in the United States—and more are coming into existence every week—a competent authority states, less than 200 are considered perfectly safe in emergency landings or when the wind is from an unfavorable direction.

The question of accessibility presents a more difficult problem when the airport is to be laid out near a large town or city. The future of aviation can only be realized by the assumption that the great air terminals of the future will justify expenditures of millions of dollars for site, construction and equipment. They will handle a volume of traffic compared with the great rail terminals of today. They must

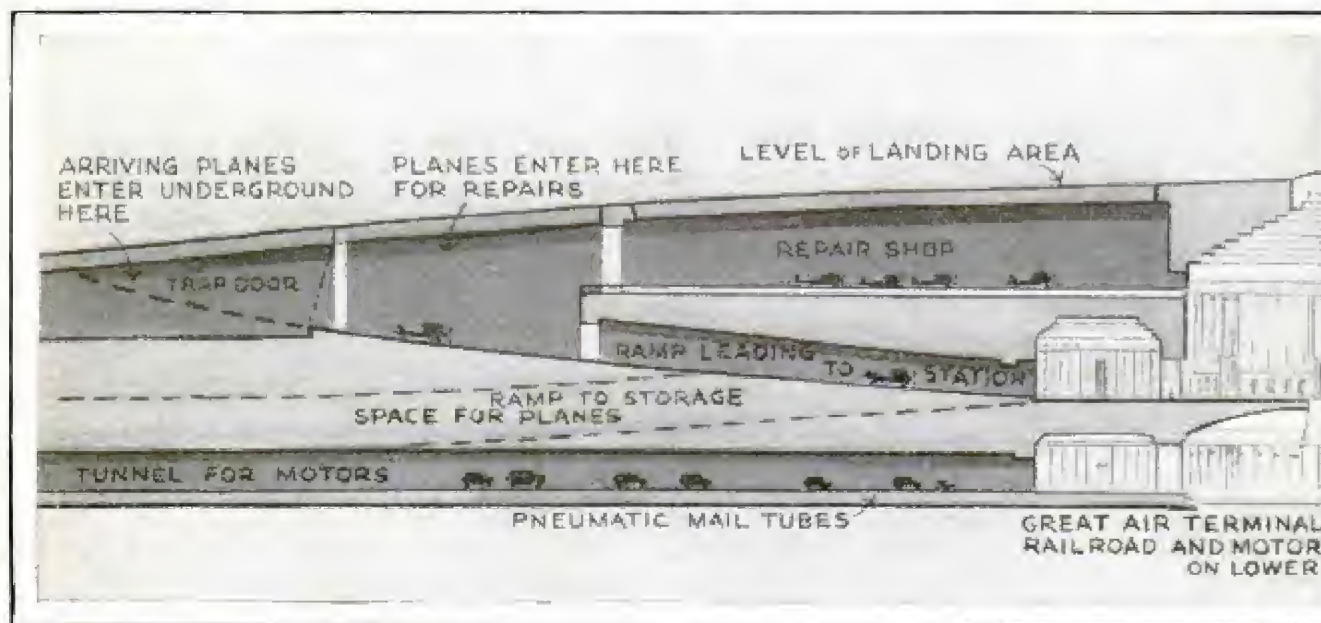
possess ticket, freight and express offices, custom, quarantine and immigration stations, post offices, baggage departments, news stands, rest rooms, drug stores, restaurants, first-aid stations, meteorological stations, pilots' quarters, managerial offices and other equipment. The landing field must be of sufficient area and of an all-way plan to permit the departure of large planes every few minutes of the day and night. As the air mail is the backbone of commercial aviation in this country, and mail pilots at this writing are flying 40,000 miles each twenty-four hours, the problem of providing for the expeditious handling of this mail either now or in the future is a vital one in the case of all airports in communities that want air-mail service. A prominent postal official is quoted as predicting that all first-class mail will go by air within three years. But at present, on short flights, the transport of air mail between airport and terminal may often take longer than the actual time the plane has been in the air. To overcome this handicap, prominent architects, aviators, engineers and postal officials have recommended the installation of pneumatic tubes between airports and post offices.

What size should an airport be and how costly? In the opinion of a large number of experts, the size of the field, provided it meets with the minimum requirements for safety and does not ignore the possibility of future expansion, must depend upon

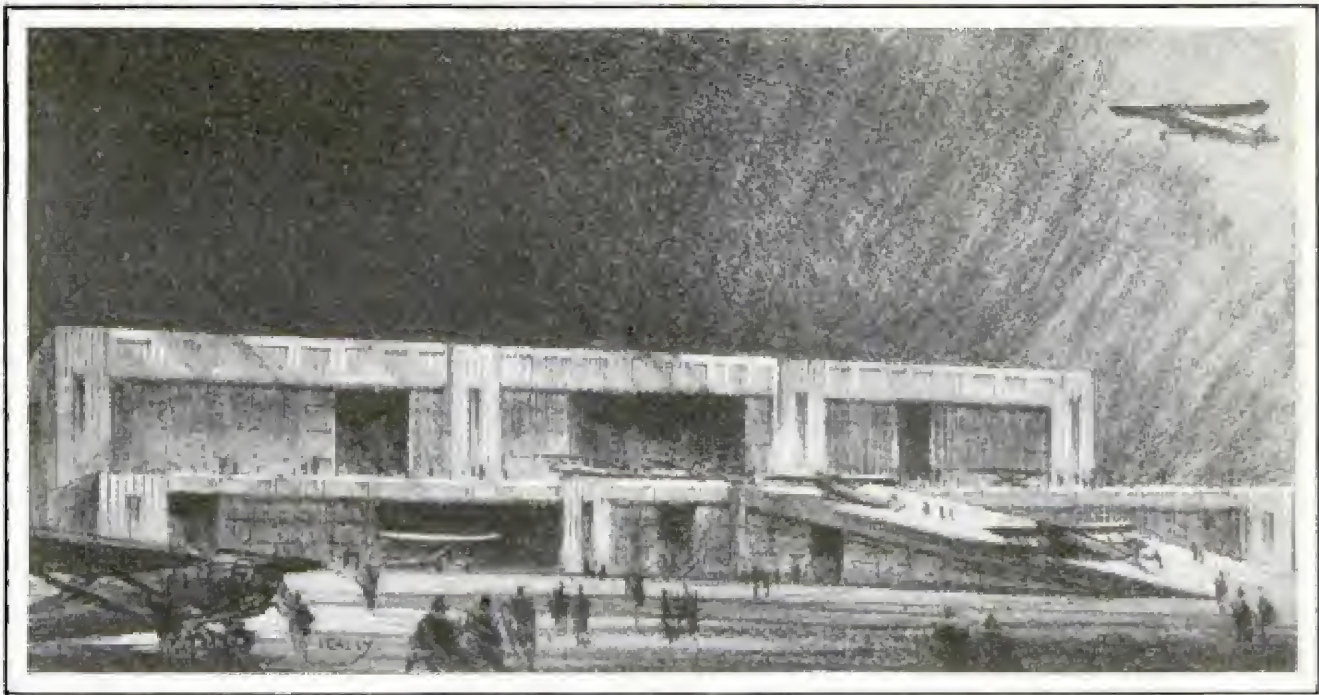
the population of the surrounding district and nearest town. There is scarcely any limit as to cost. An airport may cost a million or more. Hangars and buildings may run up to half a million. But this need not prevent any community from making a start and establishing a first-class landing field at comparatively small outlay.

Every town will start with the idea of eventually acquiring a No. 1 rating. Under the airport-rating regulations of the department of commerce, the field, to secure this rating, should have at least 2,500 feet of effective landing area in all directions with clear approaches and must be in good condition at all times. Or it should have landing strips not less than 2,500 feet long and 500 feet in width, permitting landing in at least eight directions at all times, the landing strips not to cross or converge at angles of less than forty degrees. The very minimum of safety for the largest planes is 1,500 feet of runway, but as a matter of fact the runways should be 2,500 to 3,000 feet in length. The ideal field would be a mile square, 640 acres. A 160 to 200-acre plot of level land will serve most smaller communities.

The builder of an aviation field in central New York state approached the local chamber of commerce in reference to securing a site. The chamber in turn took the matter up with public-spirited citizens and leading farmers of the vicinity. A farmer was found who was glad to lease



A Plan for an Underground Airport Terminal with the Cone-Shaped Field Free of Every Obstacle, Including People; at the Top Are Trapdoors through Which Planes Enter and Leave



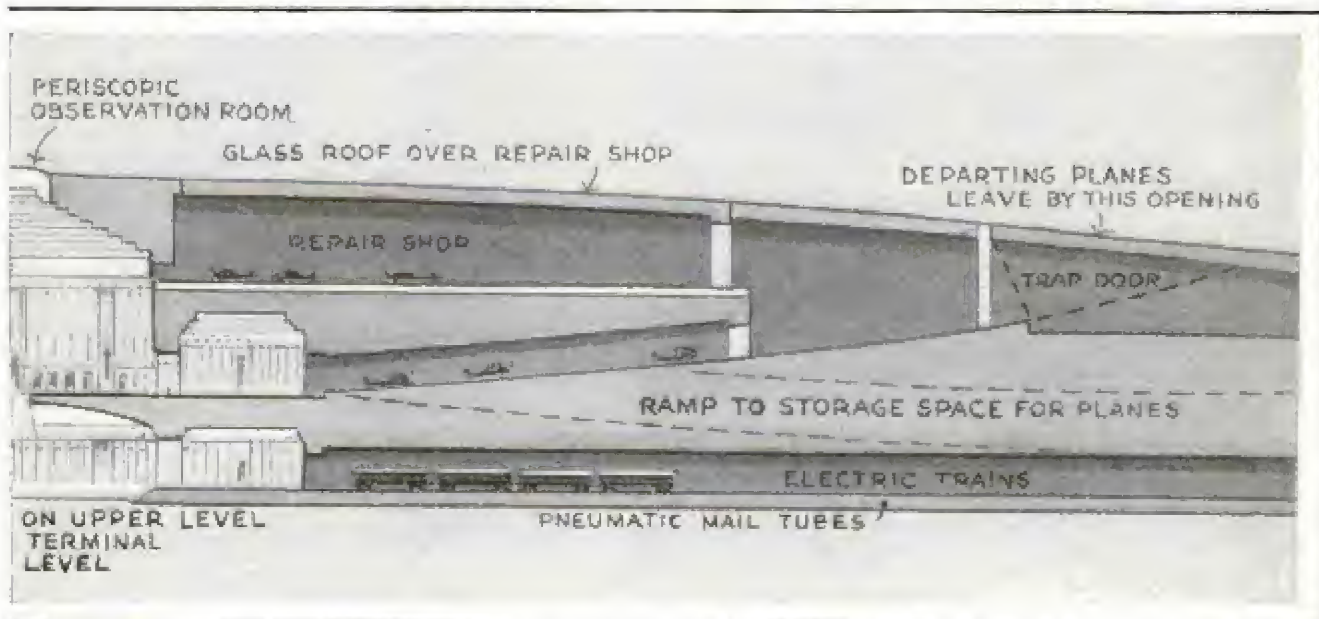
Perspective of a Two-Story Airplane Hangar Developed with a Concrete Ramp, the Second Story Being Used for Small Ships, and the Ground Floor for the Large Commercial Planes

a square level plot of 160 acres, free from high-tension wires or other obstructions, at a low rental for a term of twenty years. The promoter of the project was careful also to lease some land on the other side of the highway adjoining the landing field, as a parking site for motor cars.

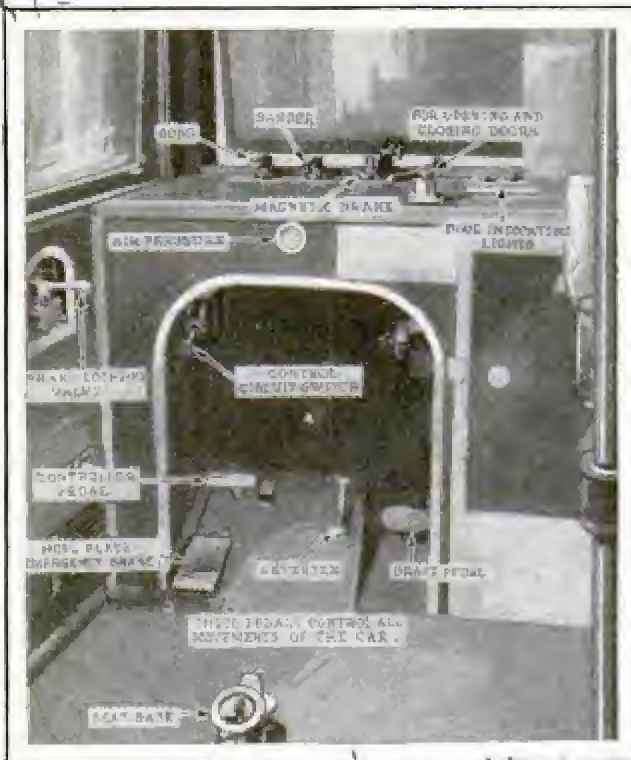
The process of getting the field in shape was that which will be adopted in most instances. A runway was staked out in the direction of the prevailing wind. Then two other runways in the direction of the next prevailing winds. All obstructions, small pines and other trees, ditches and small gullies were removed. Obstacles in

the vicinity of the field were marked with red flags. A mowing machine was run over the land which was leveled and graded. A large white circle was marked in the center of the field which could be spotted from the air, designating it as a landing field, with an arrow pointing north so that a pilot flying over the field could see it clearly. A wind indicator also was installed.

A field like this one shows how quickly the basis of an airport can be established. Drainage should be accomplished by a grade of about one and one-half per cent and not over two per cent.



The Underground Terminal Would Contain Railway Lines, Motor and Bus Lines, Pneumatic Mail Tubes, Hangars, a Hotel and Restaurant as Well as the Repair Shops for the Planes



Control Board of Street Car with Foot-Operated Speed and Brake Pedals like an Auto

FOOT-CONTROLLED STREET CAR OPERATED LIKE AUTO

Increasing speed, safety and comfort, a foot-controlled street car, operated like an automobile, has been introduced in Albany, N. Y. On the floor of the trolley car are the controller pedal, corresponding to the accelerator of the automobile, a brake pedal, reverse control, and emergency brake, all operated by the feet. The gong, sander, magnetic brake and brake-locking valve are manipulated by hand.

PLANT FOOD DOUBLES GROWTH

Containing the extracts of several chemicals essential to plant growth, a plant food now is available, which, tests show, will double the rate of growth and the size of water and garden plants. The preparation comes in liquid or solid form and was developed primarily for water lilies, but has been found equally effective for other forms of plant life.



A Revolving Serving Tray for the Dining Table, Which Allows Guests to Help Themselves

SIXTY-THREE-STORY BUILDING IS MOST ECONOMICAL

For city realty where land is worth \$200 a square foot, a sixty-three-story building will yield the greatest return on the investment, according to results of a survey for the American Institute of steel construction. Where land is worth double that amount, a seventy-five-story building would pay best. The engineering difficulties of a building 2,000 feet tall, or nearly 200 stories, could be overcome, the survey showed, but such a structure would not be feasible economically, and even a building 131 stories high would not return a net income. An eight-story building would cost \$22,193,000 to build and would yield 4.22 per cent on the investment, while the sixty-three-story building, costing \$39,100,000, would return 10.25 per cent. For higher buildings the return decreased, although on higher land values, the seventy-five-story building was found to give the greatest return. The limit to buildings is imposed chiefly by the elevators, as the cables gradually become too heavy for greater heights, while the normal human eardrum cannot stand an elevator speed over 1,500 feet per second, necessary in a 2,000-foot building.

REVOLVING DINING TABLE TRAY DOES WORK OF SERVANT

Doing the task ordinarily required of one servant, a revolving serving tray for the dining table has been made in Germany. The tray has double ball bearings and is equipped with knobs at the edge to facilitate turning by any person seated about the table. Dishes from which guests are to be served are placed on the tray which, when turned, brings the desired food before the person revolving the container. It may be covered with felt or a doily to protect the surface from blemishes from hot dishes.



Spectators at a British Outboard Motorboat Race Are Seen Dodging for Cover as One of the Boats Leaped Out of the Water and onto the Bank When the Pilot Was Thrown Out

SPEED BOAT LEAPS ONTO BANK WHILE OUT OF CONTROL

Spectators at the outboard motorboat races at Rickmansworth, England, recently were afforded an extra thrill when one of the boats leaped out of the water and onto the bank, landing among automobiles and onlookers. The boat came catapulting through the air from the water when the pilot was thrown out while making a sharp turn. Neither pilot nor spectators were injured.

BEAVERS STOP LAKE SEEPAGE WHEN ENGINEERS FAIL

When engineers and members of the state game commission three years ago failed to stop the seepage from Goose lake, one of the greatest trout lakes in the state of Washington, they decided to let beavers do the task and liberated a pair there. An examination recently showed the increased colony had built a dam which prevents the water from running into a crater and makes the water level several feet higher. The animals still are improving their dam although it is about water-tight,

and are also trying to plug another hole in the bottom of the lake. The lake is used by the state as a breeding and hatching place for trout.

JEWELERS' REVOLVING STAND KEEPS TOOLS IN ORDER

For the use of the watchmaker and jeweler, a revolving tool stand on a ball-bearing base now is on the market. The stand is of hardwood and has space for from sixty to 150 tools which fit in holes of varying size, keeping them always within sight and reach of the worker. The stand also contains bottles to hold materials or small parts and serves to



keep delicate instruments and constantly required tools off the workbench.

☐ Radium is found in extremely small quantities in living plants and animals, according to a Russian scientist.

Lucy Henry Paulson

347

C. D. Craggood, 5 1/2 Market Square, Hamilton, Maine

Ant. Paul

2881

Chas. H. P. / W. H. P. / W. H. P.
 Superior, Wisconsin R. R.
 Grand Rapids, Mich.



Bucking a Drift That Has Filled a Railroad Cut; Winds Add Their Toll to the Annual Cost of Keeping the Lines Open, Especially Where Depressions Catch the Snow

By PAUL D. PADDOCK

"IT'S snowing again. A stiff gale is blowing and the snow is drifting badly. Looks as though the trains will need some help."

A mirthless grin spread over the face of the Pennsylvania railroad train dispatcher at Grand Rapids. "I thought we'd hear from you before night," he barked back. "Well, don't worry. The 'felt-boot' boys will dig you out. So long."

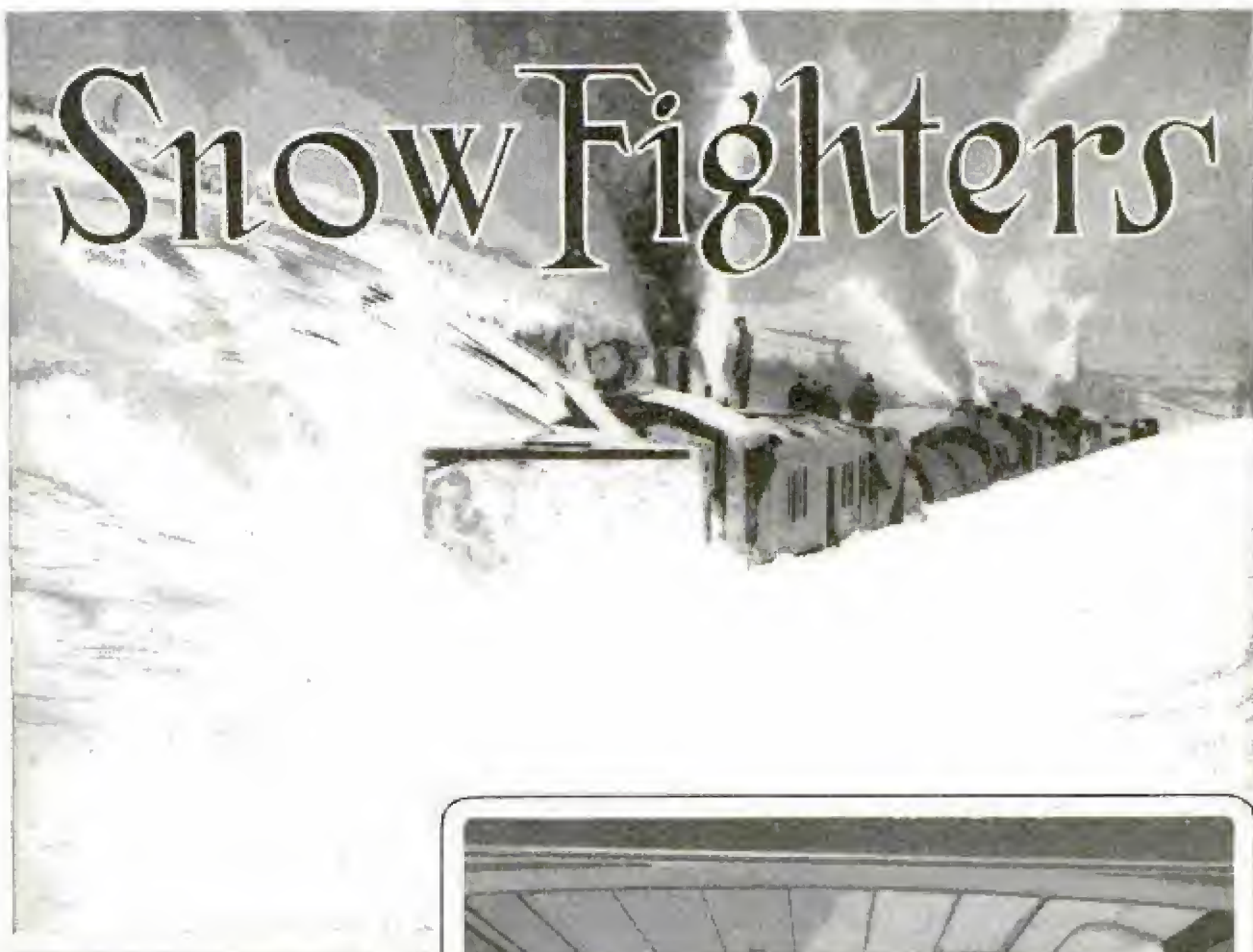
The phone call was from a northern Michigan town, far up in the snow country, where drifts, ten, fifteen and sometimes twenty feet high, pile into the railroad cuts, choking traffic and challenging the crews of felt-boot boys, the railroad's name for the snow-fighting squads, picked men who know every inch of the tracks and who can stand the rigors and bitter cold of rides with the plows in the dead of night and in sub-zero temperatures.

The snow battle is a winter struggle for many railroads, a fight that costs thou-

sands of dollars annually. Its hardships and technique are well illustrated on the Pennsylvania's Michigan line, where the tracks run consistently northward, giving the prevailing winds that sweep across the land at right angles, a clear chance to fill the cuts with snow. In one stretch, only forty-eight miles long, there are 172 cuts, open invitations to drifts. In spite of the heavy snows of last winter, more than ninety per cent of the line's passenger trains made schedule time during the winter months, and freight traffic was kept moving.

The first call for help is the signal for the snow battle to begin. The dispatcher calls the various stations along the line, jotting down the reported temperatures and the snow measurements for each place. The power man, in charge of engines, calls for a locomotive and a plow, the crew is summoned, the dispatcher clears the line for the snow fighters and

Snow Fighters



they are off, frequently in the dead of night when the tracks are less occupied with other traffic, or in a blinding storm with a roaring wind hurling sleet and snow upon the rails almost as fast as the plows can remove it.

The plow, of course, is at the front, behind is the locomotive and then the caboose. The engine cab and space between the cab and tender are hooded with a big canvas shield that also covers the coal to keep out the snow and ice. The front windows of the cab are boarded up to protect them from chunks of ice and hard snow. The engineer and firemen are literally bottled up inside their engine. The train is directed by the men in the plow. They communicate with the engine crew by electric signals.



Rotary Plows Fighting the Drifts on the Union Pacific and, Below, inside the Operating Cabin of a Pennsylvania Pusher Plow

"All set?" asks the conductor who sits on the right side of the cupola, far to the front of the plow.

"O. K. here," reply the men in the plow's cabin. Two maintenance-of-way men are

usually carried on the plow beside the two who sit up in the cupola. The conductor reaches up, and pushes the electric button twice—the starting signal. Two short blasts of the engine's whistle reply, and the snow train clatters out of the yards.

The odd-looking train, with its ugly-faced knife-nosed plow at the front, has left the city and reached the main track. Five buzzes on the electric signal tell the engineer to increase speed. Through the small windows in the cupola, the headlight, a powerful beacon attached to the front of the plow, shows the storm a whirling mass, obscuring the rails and the right of way for yards ahead. The men rub the windows every few minutes with waste, saturated with wood alcohol to keep the interior surface free from frost. The 100-ton plow is springless and it bumps and jolts as it strains through the snow. Chunks hurtle against the sides and strike the windows. The noise is terrific. Both men are anxiously straining their eyes to pierce the blinding film outside.

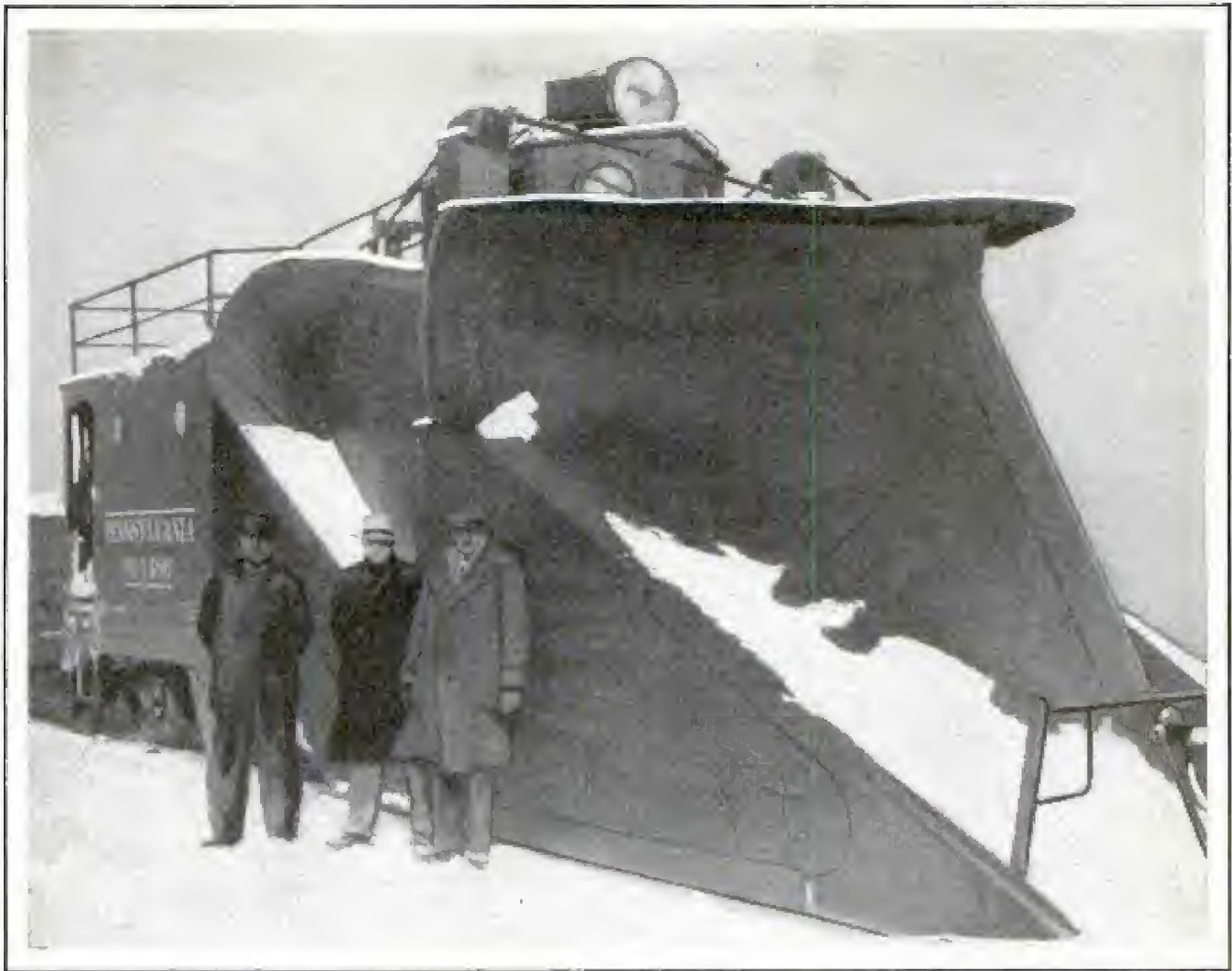
The order is to plow and flange the main line and passing sidings between Grand Rapids and Cadillac. The flanger

is the smaller hidden plow that extends down from the bottom just ahead of the rear trucks. It is V-shaped and slices out the snow and ice between the rails. It is lowered to about three inches above the rails when the plow is in operation, and so must be raised when the train approaches planked road crossings, switches and frogs. The big wings that stick out at the sides of the plow must also be pulled in at mail cranes, sidings, station buildings and other obstacles along the line. For this reason, the men who operate the levers that perform these functions by means of compressed air from the engine, must be familiar with the track. If the obstructions are not visible, the crew must know where they are, so that the flanger and the wings can be withdrawn to safety.

A green light looms hazily out of the foreground. "Get your wing in," the conductor yells at his companion. In flies the brakeman's lever, and the ponderous wing that normally protrudes at an angle of thirty degrees, strikes the side of the plow with a crash as the train shoots by the switch at thirty miles an hour. The hissing of the compressed air, the crashing of the snow, the roar and creaking of the



Northern Michigan Offers the Snow Fighters Some of the Stiffest Battles of the Year; Winds Often Fill Cuts like This, and the Snows Are Deep on the Level



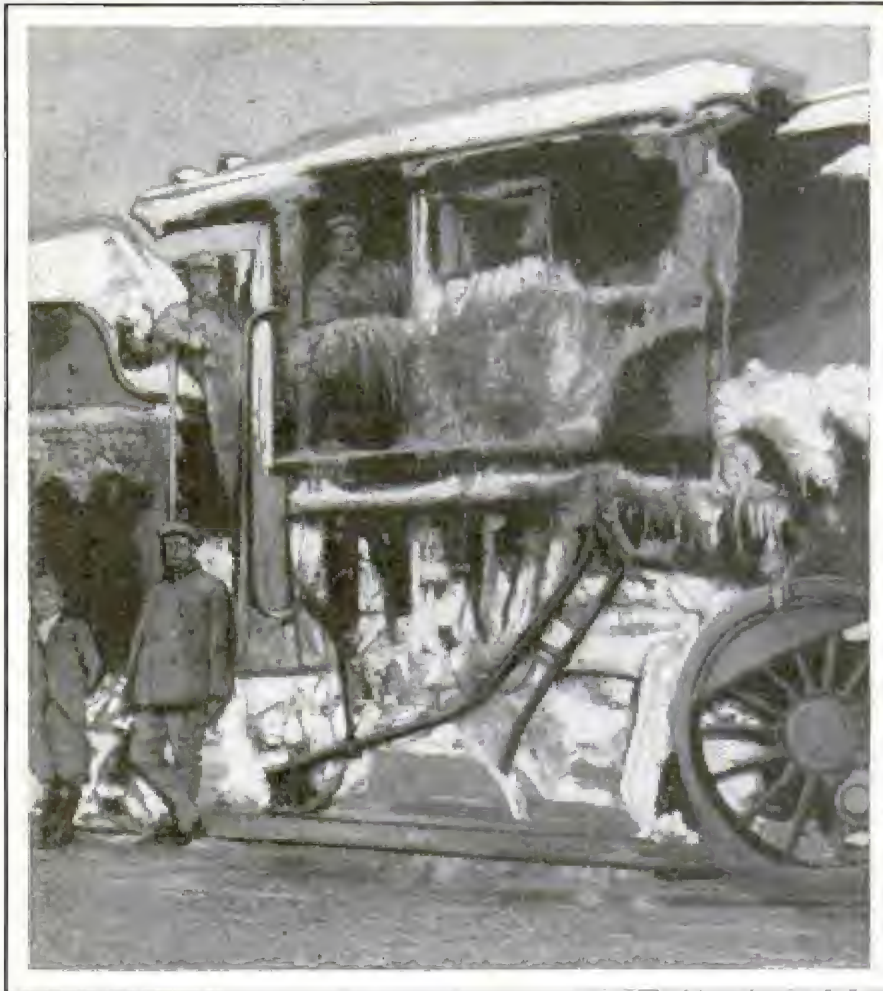
Exterior of a Pusher, Showing the Long, Sharp Nose, the Lookout Windows, Searchlight and the Wings, Folded Back Here and on Each Side behind the Nose

plow make conversation in normal tones impossible. Orders are yelled at the top of the voice, although the men are as close together as they would be in a submarine.

"Look out, we're going into a big one"—and as the plow buries its nose into a drift, there is a lunge and slackening of speed. The impact is almost violent enough to throw the men out of their seats, but they are braced for it. There are no lights inside the plow when it is operating, and the only gleam visible is that of the headlight, but this is now hidden as crashing breakers of snow cascade over the plow, plunging everything into total darkness. Another drift!

This time the speed decreases until there is danger of stalling. "Get your wings in quick," shouts the conductor as he pulls at his own lever. Both wings fold inward just in time. Stalling in a big drift with the wings out is "fatal," one of the unpardonable sins of snow fighting, for with the wings out, the train cannot

back up or go ahead and the plow is stuck, may be for hours, until it can be dug out by hand. Pulling the wings in reduces the side pressure. The big road locomotive snorts and the plow groans through the tightly packed mass of snow. But still the inside of the cupola is in darkness. The snow has stuck to the plow and the windows. The conductor gives two buzzes. The train stops on the other side of the cut and the maintenance-of-way men, who have been hugging the stove back in the plow cabin, climb out and shovel the snow away from the windows and the nose of the plow. The moment's lull gives the conductor an opportunity to confer with the engineer. The engine is a shapeless mass of snow and ice. Under the canvas canopy, although the thermometer is well below zero outside, the heat in the engine cab is oppressive, and both the engineer and fireman are sweating. "If that last one had been 200 feet longer, we never would have made it," de-



Snow Clogs the Engine Cab as Well as the Tracks; Engines Used behind the Pushers Are Generally Sheathed in Canvas to Protect the Crew and Coal

© International News

clares the engineer, wiping his face and getting a breath of fresh air for the first time since the train started. The ventilator in the cab is covered with canvas so circulation inside is none too good.

Sometimes the plow gets stuck even when the wings are pulled in. In such a case, the train is backed up for a mile or so and the plow makes a run at the drift, bucking into the pile at fifty or sixty miles an hour. The most efficient plowing speed is twenty-five or thirty miles an hour.

Off again, plunging through one drift after another. A little town flashes by, just a few lights showing through the gloom, one in the operator's office at the station, and the other, the block light. The station agent waves a greeting as the big plow roars through. He is glad to see the plow, for it means an open line and less worry.

The five big pusher plows on the Pennsylvania's Michigan line cleared nearly 9,000 miles of track in three months and

a half during last winter. At one point, there was a total snowfall of nearly forty-eight inches during January and February, and twenty-foot drifts were encountered at many places. Where it is practical, many lines prefer the pusher plow, for, although it does not hurl the snow so far out of the right of way as do the big rotaries with their huge blades, it can be operated more rapidly. The rotaries function through a gear arrangement of limited speed, but the pushers can be shoved ahead as fast as the snow will allow.

The technique of snow fighting on the railroads changes but little from year to year, and the task is about as difficult now as it was a decade or more ago. But improved weather service has aided, as the plows can be in

order and often at the scene before the snow has had time to pack and freeze.

ARTIFICIAL DAYLIGHT IS BEST FOR COLOR MATCHING

Artificial daylight electrically produced was urged before the Illuminating Engineering society as a substitute for the traditional north skylight favored by artists for color matching. Tests have shown that daylight from the northern sky, far from being standard, actually varies in intensity and character each hour of the day. White light, corresponding to noon sunlight on a clear day, was found to be the proper standard for accurate color matching and color discrimination. While this is available naturally only an hour or two a day, tungsten incandescent lamps and color filters can produce it artificially whenever needed. Artificial northern skylight, like the real article, is bluish, making certain colors appear bluer and suppressing certain other colors.

Artificial Daylight is the best for color matching.

U. S. HAS THE WORLD'S LONGEST DIRECT PHONE CIRCUITS

With the completion recently of a direct telephone circuit from New York to Tampa, Fla., a distance of 1,225 miles, another link was added to the telephone system that connects distant cities directly, without the necessity of switching calls through intermediate points. The direct-circuit network already includes the world's longest continuous telephone line, or rather twin lines, for there are two such circuits, each 3,412 miles long, between New York and Los Angeles. Supplementing this direct coast-to-coast service, there are four 2,600-mile circuits from Los Angeles to Chicago and thirty-three direct circuits between Chicago and New York. This latter group requires 29,882 miles of wire. Among other long direct circuits is one of 1,900 miles from New York to Dallas; two of 1,700 miles from New York to Havana, including in their mileage the world's longest submarine telephone cable, from Key West to the Cuban capital; four of 1,400 miles each from New York to Miami, and three of 1,450 miles each from New York to New Orleans. These lines enable distant calls without delay.

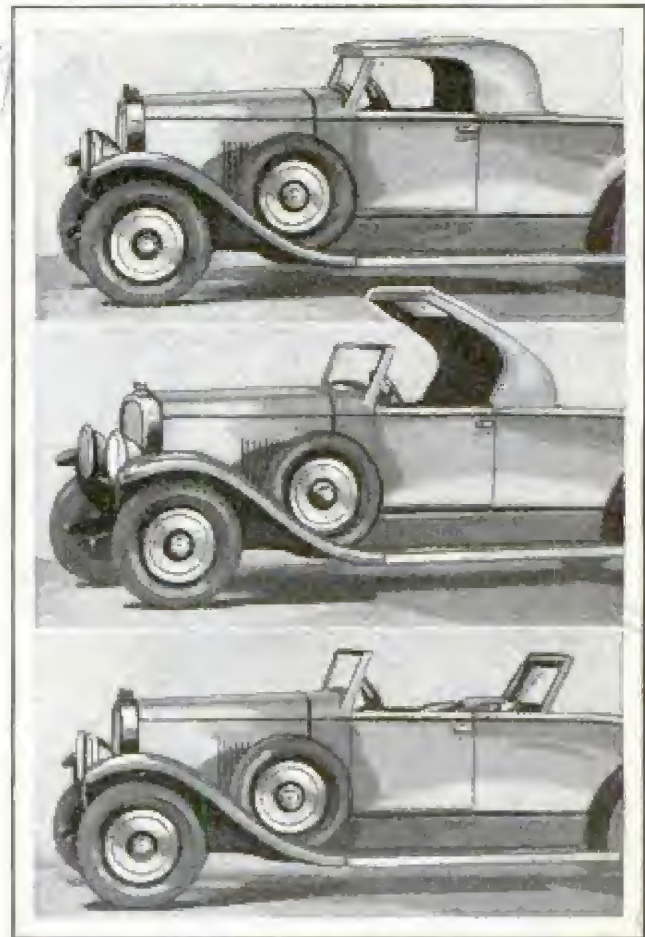
WHEEL CHAIR FOR INJURED DOG AIDS IN ITS RECOVERY

Convalescent dogs now enjoy many comforts, including wheel chairs. "Jackie," pet of a Dallas, Tex., family, was run over by an automobile and crippled. A wheel chair was provided, and the animal, while

A Wheel Chair Provided for a Dog That Was Injured in an Automobile Accident



unable to walk, learned to pull himself about with his front paws.



Three Views of the All-Metal Top, Which Slides into the Body of a Convertible Coupe

CONVERTIBLE COUPE PROVIDED WITH A METAL TOP

Motorists who like an open coupe in fair weather and a fully inclosed one in bad weather will be interested in a convertible coupe with a metal top now on the market. The convertible feature is gained by dropping the top partly into the body; the forward portion of the roof extending above the body and serving as a windshield for the deck seat by reason of the transverse window in this part of the roof. The metal top has its lower edges flared outward at sides and rear, this flanged portion normally pressing against a rubber strip at the edges of the body surface, to provide a waterproof junction. The flange is wider at the rear to give sufficient clearance for the top when it is moved backward into the body. When down, the top has the same backward tilt as the forward windshield. When the top is up and the door windows raised, the car conforms in appearance with usual coupe-body designs. The raising and lowering of the top is accomplished as easily as moving the deck seat.

Handwritten notes:
3212, 2nd. 2nd.
3, 4, 7, 2
42 June 1922
Ellenbeck
42 June 1922

3468
Tilted Coal Truck Fitted with Chutes from Which Baskets Are Filled without Shoveling



2641
COAL TRUCK FILLS CONTAINERS WITHOUT HAND SHOVELING

Delivery baskets are filled from German coal trucks without hand shoveling by means of a device at the rear of the truck. The truck itself is tipped up and the coal pours out through two hoppers into the baskets which are held beneath them in a fixture attached to the truck.

CHEMISTRY TO OUTLAW WAR SAYS NOTED SCIENTIST

Modern chemistry and modern aeronautics have virtually made another war impossible, for they would render armies useless, Francis Patrick Garvan, of New York, recently awarded the Priestly medal, the highest honor in chemistry, has declared. In case of a modern war between great powers, he said, it would be foolish and useless for a battleship to leave its dock or for an army to take the field, because modern chemistry and the airplane could destroy both. He advocated strengthening the possibilities of both agencies as weapons of war in order to discourage offensive wars.

3477 | ENGINE BUILT LIKE A BARREL TO HELP FLYERS

A barrel engine, which, unlike previous motors of the type, has a fixed barrel, was demonstrated at the British Aero Show, in London. A similar engine, the "Almen," was flown several years ago in America, and another was flown recently in Switzerland, but both these had revolving barrels, and met the same objection as was applied to the now discarded Gnome rotary engine. The new motor, which has been tested successfully in a six-horsepower compressed-air-driven model, is a radical departure. The six cylinders are arranged lengthwise around the shaft in one end of the barrel. The pistons, moving back and forth in them, impart undulating or oscillating movements to a ring fitted with teeth. There are four toothed rings which take up the oscillating motion and transform it into shaft revolutions. The speed of the shaft is controlled by the ratio of teeth in one of the ring pairs, the test engine producing 500 revolutions for every 2,500 piston cycles. The engine, it is claimed, can be equipped to operate either on gasoline or heavy oil as easily as any other motor, for the cylinder and valve end conforms to standard practice, save for the cylinder arrangement. The advantage claimed for the barrel type is the very small frontal area, which causes less wind resistance and makes nose cowl for an airplane more practical. In large units, it is claimed that another cylinder and piston unit can be placed on the other side of the oscillating member.

85.00
RUBBER TAIL LIGHT FOR TRUCK PREVENTS BREAKING

Tail lights for trucks, set in a rubber base to prevent breakage, now are on the market. The rubber frame bends when an obstruction is encountered. The light is proof against water and dust as well as vibration.



Champion Rubber
Lamb G. 1236 W 55-11

Shooting at the Moon

By JOHN T. BRADY

SHOOTING a rocket from the earth to the moon is no longer merely a fantasy of the mind. In fact, the first shot has been fired in what promises to be the most spectacular "battle of the century"—man's struggle to conquer interplanetary space.

And as a result of the success of the experiment, Prof. Robert H. Goddard, of Clark University, claims that he has now solved all the major problems of accomplishing such an amazing feat. Moreover, he declares that the first practical test, outside a laboratory, of a working model of his rocket at Worcester, Mass., proved to his own satisfaction and that of other scientists who witnessed it, that a larger rocket of similar design operating on the same principle can be constructed which will have sufficient velocity to escape the earth's attraction and soar to any desired altitude—to the moon or any one of the planets in the solar system.

Startling, indeed, are such statements, even in this age of scientific wonders. Yet, coming as they do from a conservative, cautious scientist, with a high reputation at stake, and who has spent twenty years in research and experiment on the problem of reaching extreme altitudes, they must be given serious consideration.

And one needs no other stimulant to the imagination to conceive that in the not distant future passenger-carrying air-



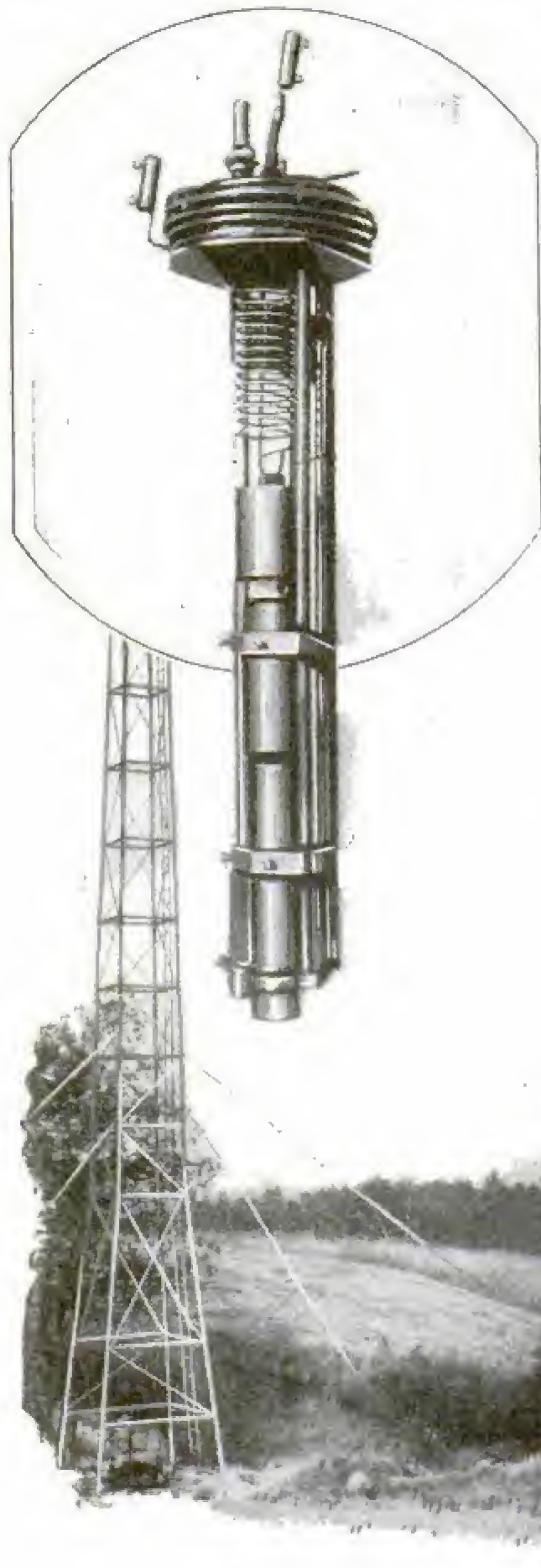
Prof. Robert H. Goddard, of Clark University, with Model of Rocket He Has Devised to Explore Atmosphere at Great Heights

planes propelled by the rocket-principle engine will shoot across the Atlantic, the Pacific, or the United States in a few hours, and that eventually man may journey to the moon, or Mars and Venus.

Professor Goddard describes the working model of his rocket as being nine feet long and two and one-half feet in diameter, with an outer shell of aluminum, highly polished and tapered at the nose to offer the least wind resistance.

Inside the shell is a highly complex mechanism, the result of many years of study and experiment, but Professor Goddard is maintaining strict secrecy as to how it works and the nature of the propellant that he is using. Explaining the reason for this secrecy he said:

"There are many things about this great undertaking which cannot be made pub-



lic at this time if the United States would maintain its supremacy in this field of scientific achievement and retain secrets of physics that may prove of inestimable value in safeguarding the life of the nation in case of war."

He said, however, that the propellant he is using is something new, a combination of liquids and gases that has taken him nine years to develop, and that the propelling force is not a series of explosions, but is continuous.

No high-powered machinery was used to give the rocket its initial lift skyward. It was launched from a sixty-foot steel tower, with guide rails, under its own power, and the initial velocity was upward of five miles per second. It carried instruments for recording the altitude which it reached and the temperature there, and the whole apparatus was brought safely back to earth by parachutes and was recovered immediately.

"By George, it was a tremendous thrill to watch it go," exclaimed Professor Goddard. "It is almost indescribable. Naturally there is considerable noise when it is being lifted which might be mistaken for a big explosion. But the sound as it hurtles along in flight is more like the moaning of the projectile from a big gun, or a long-drawn-out rumble of thunder.

Professor Goddard then stated that the term "moon rocket," as applied to his in-

Inset Shows Inner Mechanism of One of Professor Goddard's Early Experimental Rockets, and Below Is the Scene of a Recent Test; Rockets Are Launched from Guide Rails on Sixty-Foot Tower

vention, is somewhat of a misnomer, and that it would be more correct to call it a "rain rocket," because the practical purpose of his rocket experiments is to find some method of exploring the upper reaches of the earth's atmosphere for valuable meteorological data. But in the very next breath he admitted that his ultimate object, the highest goal of his ambitions, is to send an aerial messenger to the moon and then to the planets.

"But suppose you eventually succeed in developing a rocket powerful enough to reach the moon; how are you going to prove that it arrived at its destination?" he was asked.

"The only reliable procedure would be to send a charge of flash powder to the dark surface of the moon, when in conjunction (that is the 'new' moon), in such a way that it would be ignited on impact. The light would then be visible in a powerful telescope," he replied.

Speaking of the practical value of developing rockets by means of which the earth's upper atmosphere can be explored, Professor Goddard pointed out that the greatest altitude at which soundings of the atmosphere have been made by balloons, is only about twenty miles—but a small fraction of the height to which the atmosphere is supposed to extend. "Above that altitude lies the most interesting, and in some ways the most important part of our atmosphere," he said.

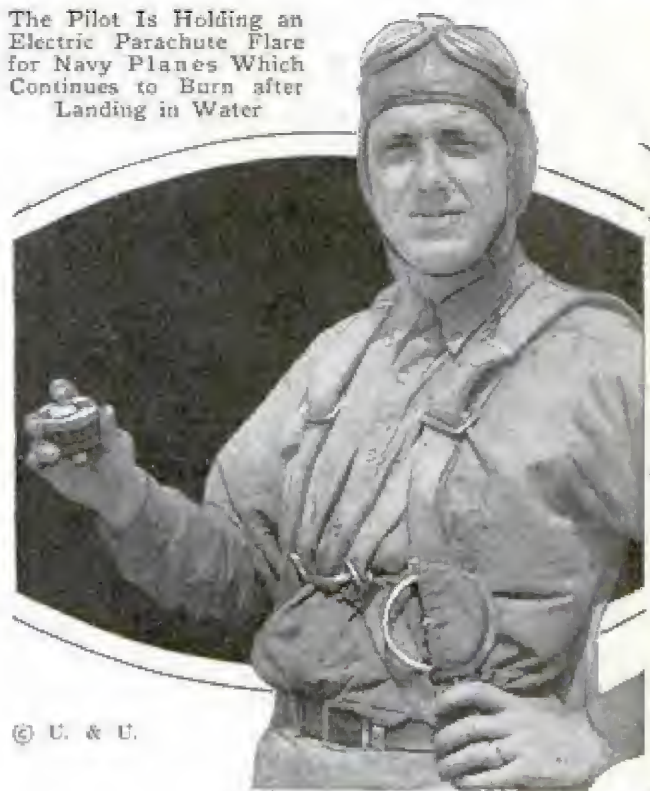
"Some authorities say the temperature begins to increase with height after a certain altitude is reached, and that it runs up as high as 1,000 degrees centigrade. Others say the temperature decreases tremendously. The earth's outer atmosphere may be very hot although nearly a vacuum. But we have no direct evidence about it. Nor do we know how the pressure falls off or the composition of the air beyond a height of about twenty miles.

"Another thing is the electrical nature of the upper atmosphere. Something like sixty miles up, there is a very rarefied gas charged with electricity and without it long-distance radio transmission would have to go out of business.

"Other problems are the nature of the aurora, the nature of radioactive rays from matter in the sun, as well as the ultraviolet rays from that body."

ELECTRIC PARACHUTE FLARE SOLVES FLYING PROBLEM

The Pilot Is Holding an
Electric Parachute Flare
for Navy Planes Which
Continues to Burn after
Landing in Water



© U. & U.

An electric-lighted parachute flare for navy planes, tested recently at the naval air station, Washington, solves, in the opinion of pilots, the problem of making night landings on water safe. The ordinary magnesium flare is extinguished as soon as it reaches the water and seaplane pilots have felt the need of a light that would continue to burn and mark the water level on which they were trying to land. The new flare, which is hardly larger than the palm of the hand, consists of a powerful electric light, operated from a tiny battery containing sufficient energy to keep the lamp burning for approximately an hour. When released from the plane, the light floats down beneath its parachute, with the rays directed downward on the water, but when it lands a cork float turns it over and the beam is directed upward. Lieut. A. P. Storrs, who made the tests, accomplished a half dozen successful landings at the Haines Point seaplane harbor, in front of the air station, using from one to two flares each time.

Names and addresses of manufacturers of articles described in this magazine will be promptly furnished, free, by our Bureau of Information.

*Not made at request of
Central Electric Co*



Above, an Electrically Propelled Towboat, and, Below, the Chain with Blades Giving It a Caterpillar Drive

CATERPILLAR BOATS ON RIVER PULL BOX-CAR BARGES

Application of railroad methods to river transportation is attracting the attention of river men and shippers of freight along the Mississippi, the Ohio, the Missouri and other inland waterways. The very latest creations in river-boat construction are electrically propelled towboats with caterpillar drive, and barges that look like railroad box cars. Small electric towboats, which draw only two to three feet of water, act as switch engines and collect the barges from shipping points along the smaller streams. The "train" or fleet of barges is then towed to distant points by larger towboats of similar or other design. As the barge fleet travels up or down a river, one of the smaller towboats detaches a barge from the fleet and takes it to a dock, where it may pick up another

barge and attach it to the fleet. This can be done without stopping the barge fleet. Wireless telephones eventually will connect the towboats. Electrical equipment for these novel towboats was designed by engineers of the Westinghouse Electric and Manufacturing company. Power for the generators is furnished by Diesel engines which burn crude oil. The smaller towboats have a fuel consumption at full load of about three gallons per hour, which means a fuel bill of approximately eighteen cents an hour. The drive on each side of the towboats consists of a chain with blades attached in a manner resembling the method of attaching buckets on a conveyor. Separate motors operate the two chains. By reversing one drive, the towboats can be turned around in their own length, and because of their small draft, the smaller towboats can reach docks unavailable to steamboats.

PLATINUM SUBSTITUTE FOUND IN "KONEL"

"Konel" is the name applied to a new metal which is being used extensively as a substitute for platinum in the manufacture of filaments for radio tubes. It is credited with being much stronger than other metals at high temperatures and can be used in the moving parts of internal-combustion engines and other extremely hot places. Originally it was developed as a platinum substitute, but was found to be harder to forge than high-speed steel, and to be very tough at high temperatures, when most metals lose their strength. Engineers believe the metal will be useful in making valves, valve stems and turbine blades. As a substitute for platinum, they estimate the metal represents a saving of \$250,000 a month, because platinum costs \$180 an ounce while konel costs \$15 a pound. Tubes equipped with konel filaments may be operated 175 degrees colder than those with platinum fixtures. Konel is also resistant to most acids.

Envelope. Mississippi Valley Barge Line - C. 408 Gene St. St. Louis, Mo.

3466 Source system

3483

Westinghouse Electric
St. Louis, Mo.

TUNGSTEN CARBIDE PENETRATES THE HARDEST METALS

Tungsten carbide, the hardest compound known to science, for years a mere curiosity, has found a commercial use, for with it hard alloys, including manganese steel and armor plate, can be machined in lathes, planers or shapers. Tungsten itself, as used in electric-light filaments, is so soft that it can be drawn into fine wires, but when combined with carbon, it makes a substance second in hardness only to the diamond, and will scratch a sapphire. At first it was too porous to stand the strain imposed on a cutting tool, but this difficulty has been overcome, and in its more useful form it is known as "carbolyd." While many operations impossible with any other cutting tool are performed with the compound, it has limitations as it will break down under very heavy pressure.

CAMERA REVOLVES TO "SHOOT" FROM ANY POSITION

Mounted on a large wheel that is revolved by a crank in a still larger wheel, Hollywood has a moving-picture camera that photographs from any angle or position in which it is placed. It is powered by motor and may be used, for instance, to create the illusion of a topsy-turvy world by exposing the film as it is revolved.



A Motion-Picture Camera That May Be Revolved to Shoot from Any Position or Angle



Upper Berths for Sleepers Provided with Windows, Which Furnish More Air Than Ventilators

WINDOWS FOR UPPER BERTHS ADD COMFORT TO TRAINS

Upper berths of sleepers on one western road now are equipped with windows to add to the comfort of passengers. The windows are smaller than the regulation car window, but provide more circulation than the ventilators in the roofs, commonly employed to supply the occupants of the uppers with fresh air.

OVER NINE MILLION VISITORS TO WASHINGTON MONUMENT

During the forty-one years that the Washington monument has been open to the public, 9,098,118 persons have visited it, recent figures show. The daily average has been 615 persons since 1888, and the greatest number in one day was 10,078, who went to the top on April 1, 1929. More than 2,500,000 energetic sightseers climbed to the top, while the remainder took the elevators.

Public demand for windows in upper berths of trains

Ch. Mark Police

3206

Making a



This Folding Ironing Board Has a Metal Holder for Hot Irons to Prevent Scorching and Fires; It Folds Up with One Motion for Storage in Small Space



Boiling Eggs Exactly the Desired Time Is Easy in This Aluminum Kettle; a Simple Device at Top Is Set, and at the End of the Period, the Eggs Automatically Are Lifted Out of the Water



The Cabinet Above, Furnished in Various Colors, Holds a Package of 125 Small Towels of Absorbent Material for Many Uses about the House; They Save Laundry Bills and Extra Steps; the Cabinet Takes Up Little Room and May Be Placed in Any Convenient Location



Here Is a Vacuum-Cleaner Bag with a Side Vent Opened and Closed by Interlocking Clasps for Quickly Emptying the Dirt; the Vent Saves Removing the Entire Bag, Prolongs Its Life and Protects the Operator from Dirt

Home Tasks Pleasure



By Pressing a Spring, the Top of This Double-Purpose Tray Can Be Raised and Tilted at Various Angles for Reading; the Sturdy Stand Prevents Tipping; Below at Right, Is a Compact Motor Unit for Beating, Extracting Juices, Slicing Vegetables, Grinding Meats and Polishing Silverware; the Set Weighs Only Forty Pounds and Is Economical to Operate



With a Portable Tipping Stand for the Washtub, the Task of Filling and Emptying the Container Is Greatly Simplified; Clamps Hold the Tub Securely in Place While Allowing Quick Removal





A Toaster Which Heats the Inside of a Bun Instead of the Outside for Toasted Sandwiches

TOASTER HEATS INSIDE OF BUN INSTEAD OF OUTSIDE

Toasting the interior of a bun to receive the filler of frankfurter is the purpose of a novel toaster now on the market. It consists of an upright bar inserted in a long bun, or a flat plate over which a sliced round bun is slipped. Makers claim that sandwiches prepared in this way are more palatable than those with the outside toasted, and less time is required for the operation.

PILOTS FLY SPIRAL COURSES WHEN BLINDFOLDED

Experiments by the national advisory committee on aeronautics have demonstrated that airplane pilots, when blindfolded, will nearly invariably show the same tendency to deviate from the straight path of flight and take up a spiral one, that a blindfolded person does when in motion on the ground. The blindfolded pilots, accompanied by a reserve pilot who acted in emergency, were found to bring the ship after a short flight into a properly banked turn, and most of them made the turns shorter and shorter with a tendency to turn the plane into a diving spiral. About an equal number of right

and left turns were made and the right or left-handedness of the subject pilots apparently had no relation to such turns. The experiments demonstrated that muscular balance plays a relatively small part in flying, except in correlation with visual reference. Pilots flying in the dark, it was pointed out, have this visual reference in their instruments, which provide an artificial horizon and show the course the plane is taking at all times, so that the blindfold test is more stringent than any pilot is likely to face in actual flight.

FOOT IMPRESSION ON INKED PAD REVEALS ILLS

Taking an impression of the sole of the foot to reveal pedal troubles without removing the shoe is made possible by the "pedograph," a wooden cabinet containing an inked pad. The foot is placed on a rubber sheet beneath which is a chart and when the weight of the body is pressed on the apparatus, the impression of the foot is left on the chart when it comes in contact with the pad on the underside of the sheet. It shows the condition of the arches, bearing points of the foot, callous spots and the degree of its elongation or widening.



Making a Foot Impression on an Inked Pad to Show Foot Troubles without Removing the Shoe

U.S. Navy 9/9/29

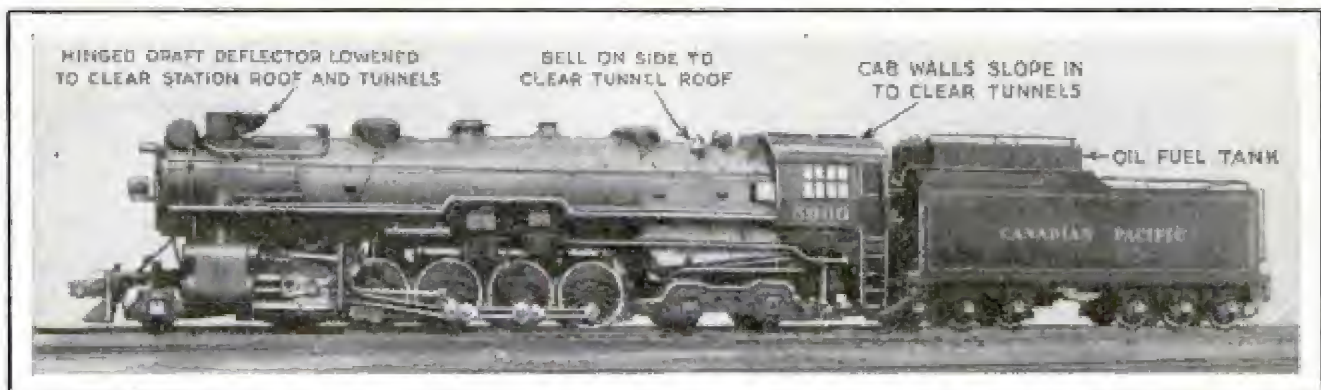
The Schooling Co

to 2nd 14, 1929

GIANT LOCOMOTIVES SQUEEZE THROUGH TUNNELS

A new series of twenty steam locomotives for the Canadian Pacific railway, the first of which was recently placed in serv-

pass under low bridges. The engines are in the 2-10-4 class, with ten main drive-wheels, and, in addition, twin-cylinder



An Engine So Large That It Was Necessary to Hinge the Draft Deflector, Slope the Cab Walls Inward and Place Bell and Whistle on the Side to Enable It to Pass through Tunnels

ice, have carried locomotive building to such large dimensions that considerable effort was required to produce a shape that would squeeze through existing railroad tunnels, and get into passenger terminals without scraping the roof. The sidewalls of the engineer's cab curve inward to keep them from rubbing tunnel walls, and the bell and whistle, instead of being placed on top of the boiler on the center line, have been moved down the side until their highest points come within the cab-roof clearance line. The stacks also are fitted with hinged smoke deflectors which can be turned back and down to get through tunnels, just as tugboats are sometimes built with hinged stacks to

booster engines on the tender wheels to increase the tractive force when starting a heavy load and then automatically cut out when a speed of twelve miles an hour is reached. The locomotives weigh 750,000 pounds, making them the largest two-cylinder railroad engines ever built in the British empire, and develop a tractive force of 78,000 pounds, in addition to the 12,000 pounds supplied by the booster. Rated at over 4,200 horsepower, they are eighty-five times as powerful as Stephenson's famous "Rocket," yet this has been achieved with only eighty times the weight, and, incidentally, at an expenditure only forty-five times the cost of the original engine.

TISSUES OF FOWL KEPT ALIVE FOR SEVENTEEN YEARS.

Tissues, taken from a fowl seventeen years ago, still are kept alive by Dr. Alexis Carrell of the Rockefeller Institute of New York. The tissues taken from the heart of a chicken are kept in a vault maintained at about blood heat, and not only live but grow so fast under rigid conditions affording proper heat, light, moisture and food, that they must be trimmed frequently. Portions of the tissues at times have been transplanted to other small flasks similar to that in which the original is kept, and they likewise are thriving. Every few days the tissues are freed from their own waste which in time

would be destructive, and the nutrients are supplied through the medium in which the tissues are bathed, the process being similar to that which kept the tissues growing when they were part of the living chicken. Then the blood supplied nutrition and the circulation removed the waste. So expertly have the same methods been simulated, that Doctor Carrell believes the tissues can be kept living indefinitely. Human tissues might be kept alive in similar manner, Doctor Carrell said, adding that the reason the cells far outlived the body of which they were a part is that nutriment can be given and waste removed under ideal conditions, something that would not be possible in the living body.

2987

3054 Redmont Ave
Oakland, Calif

How the Plane



every section of tubing in the framework of body and wing is air and moisture-proof, a precaution against inside rust.

As the welders put the parts together, an eighth-inch hole is drilled at every point where tubes are joined, and an eighth-inch plug is inserted at the top of the fuselage, at the end of the tail, and at the top of the front wing-beam member. The wing and top fuselage plugs are at the highest points when the ship is resting on the ground, and the plug at the tail skid at the lowest. The oil pump is attached to the latter, and when oil

Courtesy Mahoney-Ryan Aircraft Corporation

Girls Are Skilled in Covering Wings, Fuselage and Tail Members; Below, Men at Work on a Bellanca

"THEY are now," announced Frank La Vista, general superintendent of the Fairchild Airplane Manufacturing corporation, "about to oil up the fuselage," and before your eyes another of the unexpected things in an airplane factory begins to take place.

What layman ever heard of oiling up the gaunt steel tubing structure of fuselage and wing? Yet they do just that, and it takes forty-four gallons of linseed oil, heated to just below the boiling point, to do the job.

But why the hot oil? Because, the superintendent explains, the inspectors can tell by feeling each longeron, strut and brace, each spar and rib, whether the oil is passing through it.

For the oiling job is just a quick and clever way to determine whether the welders did a good job, and whether



begins to run out of the top holes the inspectors know that every steel tube is full.

Is Built

After the test, the oil is drained out at the tail, the holes plugged, and the metal frame given two coats of aluminum enamel.

Building an airplane is a job for specialists and experts. It takes trained men from other industries, sheet-metal workers, machinists, welders, woodworkers, cabinetmakers, upholsterers, cloth cutters, seamstresses, painters and others, gives them a special course in airplane building, and fits them for big business' newest venture—for multimillion-dollar mergers have, in the space of a few short months, turned the outcast child of a few years ago into a rising young giant.

America built 4,049 planes last year; turned out 2,000 in the first few months of 1929, and, at the rate material orders have been placed, the total production for this year may reach 10,000.

It takes trained men and women to turn out planes, and in every airplane plant in the land, specialists are being created as fast as experienced instructors can turn them out. At St. Louis, where the Mahoney-Ryan plant moved after Colonel Lindbergh flew a Ryan to Paris, men and women of seventy trades fashion and assemble the 5,506 parts which, exclusive of motor, assembled accessories, instruments, nails, screws and cotter pins, go to make a Ryan "Brougham."

At Wichita, which claims the title of "airplane center of the world," factories are as thick as automobile plants at Detroit, and this one town turns out more planes in a year than the entire country did only a couple of years ago.

How does one get to be an airplane builder? The first question every applicant is asked is, "What can you do?" and



Checking Balance and Pitch of a Propeller; It Is So Nicely Adjusted That a Piece of Paper Causes It to Turn

if the answer is, "Oh, I can do anything mechanical," the applicant probably will be shown the door. For building the intricate framework of wood and steel and fabric to which the lives of many passengers must be entrusted is not a job for a jack of all trades.

The airplane factories do not necessarily want workmen with experience in building airplanes, but they do want men who are to some degree specialists in particular trades. That does not mean there are no openings for the inexperienced, for there is a big field for apprentices to learn under the guidance of more experienced workers.

The heart of most modern planes is the welded tube fuselage of special chrome-

*Notional Seamless Tube Co. Frick Delay
Pittsburgh, Pa.
Ohio Seamless Tube Co. Shelby, Ohio*



Testing a Monocoque Frame for Strength by Loading It with Heavy Bags of Sand and Metal

Delaware Seamless Tube Co., Auburn, Pa.

molybdenum steel. With a tensile strength approximately double that of ordinary steel and many times the strength of wood, it is not only lighter but is used in sizes of correspondingly smaller cross-section area. To weld such delicate tubing properly requires the best of specially trained welders. A man who can weld street-car track joints or steel building beams, and do a satisfactory job, may lack the delicacy of touch and the ability to turn out the kind of joints the airplane factory demands, for a good weld must be stronger than the tubing itself, and frequent tests of parts make sure that it is.

Every pound that goes into the building of an airplane means one pound less of fuel or pay load to be carried. When

the Wrights built the engine for the first airplane it developed one horsepower for about thirteen pounds of its weight. That was just enough power to get the ship, with one passenger and a small amount of gasoline, off the ground, and the "ceiling" of that original airplane probably was about as high as the top of the statue of Liberty. A modern air-cooled engine weighs about one and a half pounds per horsepower, and all the saving in weight goes toward lifting a heavier plane, more fuel, a pay load, and in reaching a higher ceiling.

It would be easy, however, to use up the excess power in build-



Showing the Evolution in Steel Tubing; Although the Tubes at Right Are Much Thinner, All Have the Same Tensile Strength

ing the ship, if planes were built like automobiles, wagons, houses, or anything else that has been built before. It is because they are not, that specialists are needed, not only in the factory but in the engineering and design departments.

Consider the wing, on which the airplane's ability to fly depends. Engineers for years have used trusses and cantilever construction in buildings and great



Courtesy Mahoney-Ryan
Aircraft Corporation

Putting the "Sea Legs" on a Ryan Plane; Ships of This Type Are Being Used in Alaska, China and Other Distant Countries Where the Terrain Is Hazardous

bridges, but when the modern airplane was developed they turned out trusses and cantilever wings so delicate that, in one successful glider, the wing ribs are made of "kraft" paper, yet so strong that an internally braced structure, seventy, eighty, or a hundred feet long, can be pulled through the air at better than a hundred miles an hour without breaking or bending.

One sport plane has a wing built up of spruce ribs, each weighing but two and three-quarter ounces. Yet these tiny trusses are so perfectly made that each will support a 200-pound weight without deflection, and, if the load is evenly distributed, hold up from 250 to 275 pounds without failure.

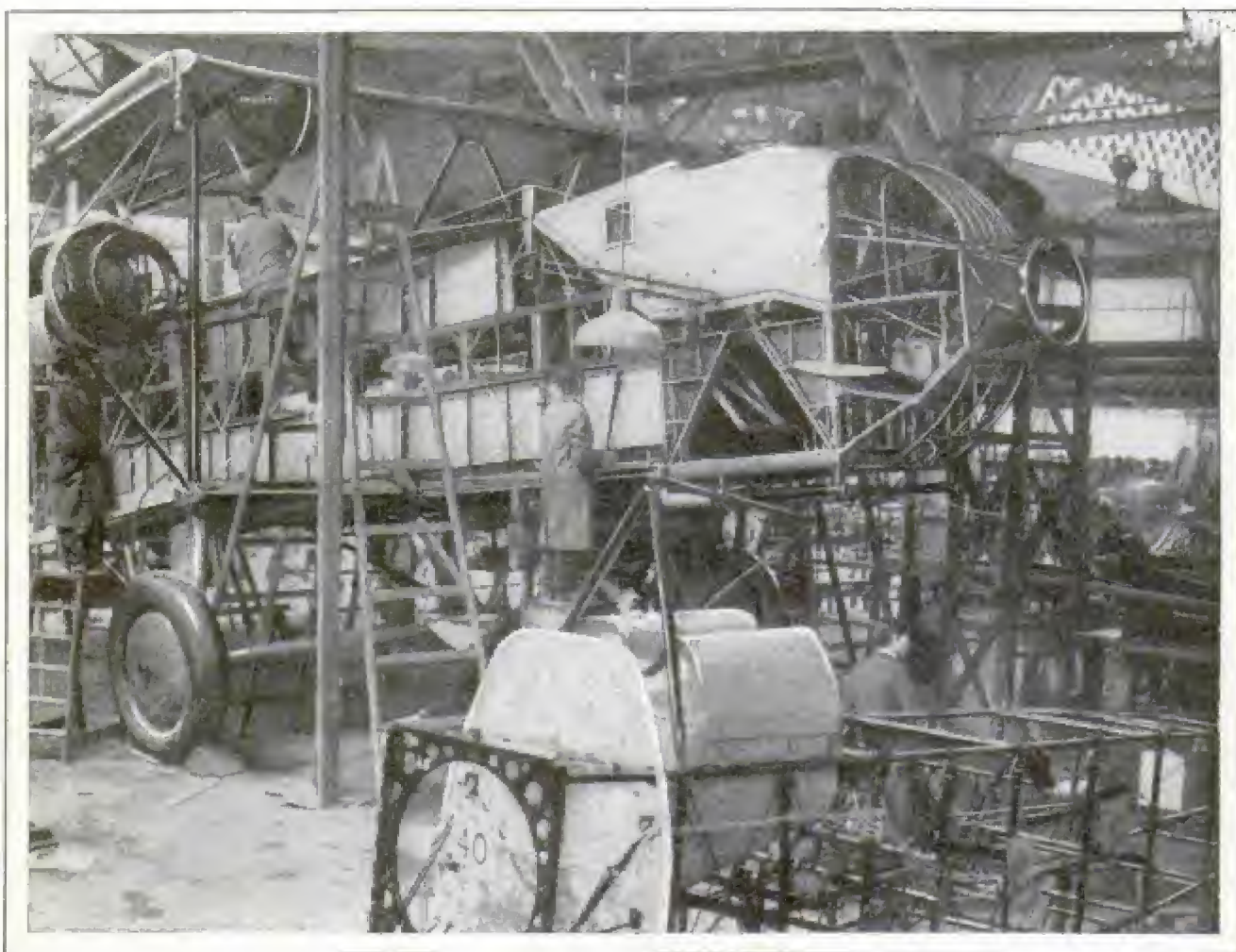
The efficiency of wing designs has gained enormous impetus from the rapid development of cabin and open-cockpit monoplanes. Although, of ships in actual service, biplanes still outnumber monoplanes about two to one, practically all cabin ships are now monoplanes. Of the 850 cabin ships manufactured in 1928, only sixty-nine were biplanes, and in the

multi-engined transport-ship class, only five out of fifty-eight air liners were biplanes. In the small open-cockpit field, however, the vast majority of the 2,348 planes built during the year were biplanes, for only 171 of them had a single wing.

Aviation engineers have turned to the monoplane largely because of its greater aerodynamic efficiency. If built as a full-cantilever, internally braced, it eliminates struts and flying wires with their drag, which cuts down speed, and in such a thick wing ample gasoline tanks can be installed, leaving more room in the fuselage for the pay load.

While the metal fuselage has become almost general in use, wings continue to be built of wood, wood and metal, and all metal, and in each class some are covered with cotton fabric and some with metal.

The wing-covering department in a factory using fabric wings offers a field for women. In the Ryan plant women are used exclusively for this work, for it has been found they do a better job than men. The cotton must be laid on smoothly and



© P. & A.

Putting the Finishing Touches on a Giant Air Liner to Sail the England-to-India Route; Note the Special Baggage Compartment below the Central Engine Mounting

under equal tension, so that, when the five coats of wing "dope" are applied, it will shrink to drumhead tightness in every part.

Wing doping is a job for painters, but it takes several months for even an experienced painter to become a good wing doper. The dope is a nitrocellulose product, closely allied to guncotton, and, under some conditions, equally dangerous while in the liquid state. For this reason the dope department is usually in a separate fireproof building, and is watched with care.

Building a ship, or rather, assembling one, for no airplane is completely built in its own factory, is a production-line job. The motors, instruments, and similar accessories are purchased outside, and come ready for installation. Wood and metal for fuselage and wings, doors, windows and the cabin fittings and upholstery are the parts worked in the plant. While one department turns out the fuselage, an-

other builds the wing, and the two then come together for assembly and covering. And after that the engine, motor, propeller, landing gear, stabilizer, rudder, tail fin, tail skid or wheel, and other parts, are added.

24/7 RATS PROVE ACQUIRED TRAITS ARE OFTEN INHERITED

A great and much debated question of evolution has been put to a practical test with twenty-three generations of rats. From observing the behavior of the rats in a tank of water, Prof. W. G. McDougall, of Duke University, has found that a trait acquired by one generation of animals appears to be transmitted to their descendants. Doctor McDougall placed the experimental rats in a tank with two gangways leading to dry land. One gangplank was brilliantly lighted and was electrically wired so that the rat that chose it was sure to receive a slight electric

shock, strong enough to be unpleasant. In such a situation, every rat learned sooner or later to avoid the lighted gangway and to choose the less conspicuous path to shore. Rats whose ancestors for many generations were placed in the tank learned to take the shockless route after experiencing from three to seventy-five shocks, or an average of forty shocks, Doctor McDougall said. On the other hand, rats whose families had no such background of tank experiences, would take an average of 150 shocks, before they learned to solve the problem.

HUMIDIFIER AND AIR CLEANER ONE UNIT 3461

Cleaning and moistening the air passing through a hot-air furnace in a single operation is the purpose of a humidifier which also serves as a cold-air shoe to be attached at the air-intake point. The shoe contains a series of water pans, one inch deep and four inches wide, extending across the shoe and arranged one above the other so that dirt or dust passing by the first row will be caught in the next. Besides the series of staggered pans, there is a large pan at the bottom. All of the pans may be removed easily and all are filled simultaneously by pouring water into a funnel at the top, overflow tubes sending the water to each row of pans in succession as the row above is filled. Sewer connections may be made to the bottom overflow tube.



Shanghai River Beggars Meeting Incoming Ships Use Nets on the Ends of Long Poles to Receive Alms

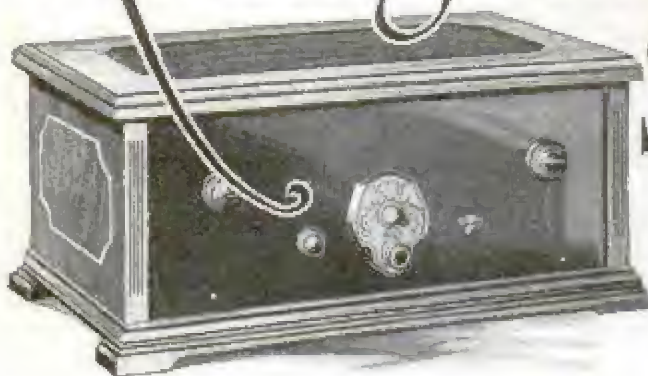
RIVER BEGGARS COLLECT ALMS WITH BASKETS

River beggars in Shanghai have found that it pays to meet incoming ships before they dock and solicit alms from the passengers grouped along the rail. They run alongside the vessels, and extend bamboo poles with nets to receive the coins.

PINK OYSTERS ARE WHOLESOME

Pink oysters, after undergoing ten years of examination, have been given a clean bill of health by the state of New York. Chemists found the pink bivalves to be as wholesome as those of normal color, while previously, dealers often destroyed consignments of pink oysters, believing them unfit for food.

Adding Audio Stages S-G Receiver



THE SIMPLE one-tube receiver described in the November issue was designed for beginners and was a complete receiver in itself; the layout, however, was planned so that either one or two a.f. amplification stages could be added with ease. No extra A or B-batteries are required for these audio stages, but there is an additional $4\frac{1}{2}$ -volt C-battery in series with the former C-battery for the purpose of biasing the grids of the tubes to be added. In the two-tube receiver shown in the first diagram and diagram No. 1A, both C-bias values may be shifted to obtain best results. For example, $1\frac{1}{2}$ -volts C on the control grid of the screen-grid tube may give better results than 3 volts, and the 9 volts C on the grid of the first audio tube may not give as good results as a lower value.

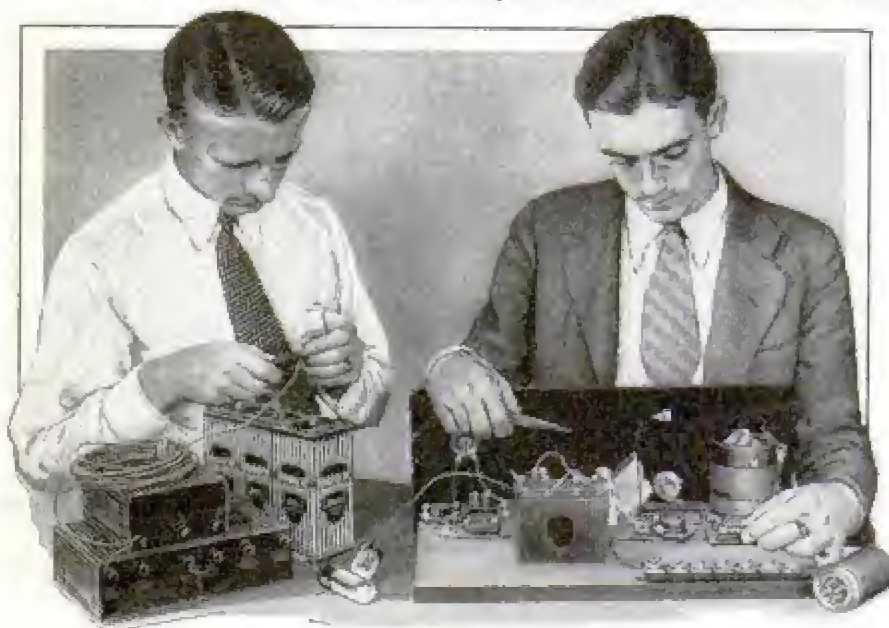
Resistance-coupled audio amplification

is used to advantage with the screen-grid tube, all that is required in the way of additional apparatus for the first audio stage being a CX-299 tube, socket, 30-ohm rheostat, a double resistor mounting, two resistors of the gridleak or "cartridge" type, and a .01-mfd. fixed condenser.

The parts are mounted on the baseboard as shown in the simplified wiring diagram on page 1001 and in the photo at the upper right on page 1003. The positive A-battery lead for the 299 tube is taken from the set side of the filament switch, and the negative filament supply is taken directly from the negative post on the dry-cell A-battery and run through the 30-ohm rheostat. The 135-volt B-line is tapped for the plate resistor and goes to the point indicated as positive-B on the resistor mount. The line to the lower phone post is then connected to the P-post of the 299 tube. The .01-mfd. fixed condenser is connected directly to the P and G-posts of the resistor stage. When all connections to the tube socket and resistor stage are made as shown in the diagram, connect the flexible leads to the batteries

and insert the 299 tube in its socket. The flexible leads, indicated as 1, 2 and 3 in the upper photo on page 1003, are the negative-A lead to the rheostat, and the two leads for the C-battery connections.

The two-tube receiver is now ready for operation. Turn on the filament switch and then turn the rheostat knob to the right until a hissing sound is heard in the phones. The tuning is done exactly as described in the preceding article. The volume on local stations is suffi-



Adding the Second Audio Stage to the Screen-Grid Receiver

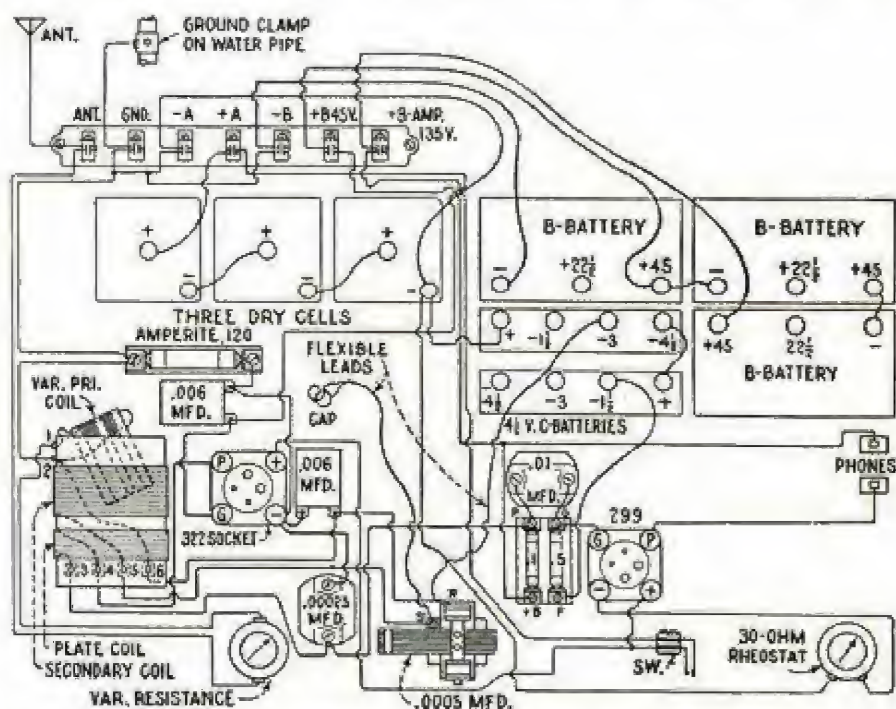
to Beginner's



cient to operate a loud speaker; for headphones the volume may be reduced with the variable resistance in series with the antenna.

To add the third tube, which is also a UX-299, no further apparatus except the tube, socket and resistor-stage unit are required. The resistor-stage unit is a duplicate of the first stage, and the connections are clearly shown in the diagram on page 1002. The plate lead to the lower speaker terminal is cut as before and moved up to P on the last socket, and P of the preceding socket is connected to P on the resistor unit. Flexible leads 1, 2 and 3 are the same as before, and lead No. 4 is the 9-volt C-battery connection from the F-post on the second audio-stage resistor unit. The 135-volt B-line is again

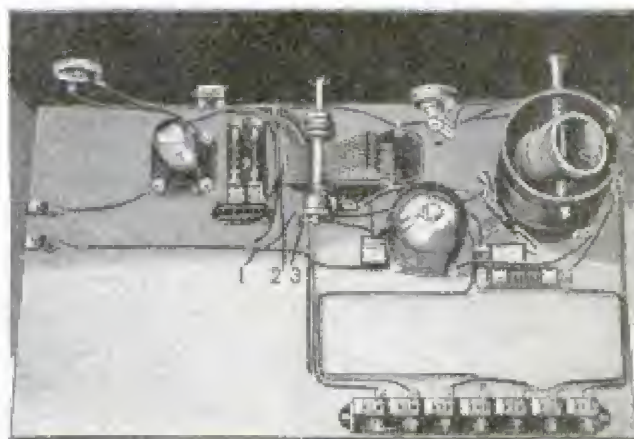
tapped for the plate resistor, and the filament connections to the last tube socket are merely extensions from the preceding tube, placing them in parallel where they are both controlled by the 30-ohm rheostat. The photo at the upper left on



Simplified Wiring Diagram of the Two-Tube Screen-Grid Receiver

with the headphones. Shift the C-bias voltages until the best results are obtained. Tuning is done as before; do not turn the condenser dial by jerks, but move it slowly and, when a station is picked up, adjust the volume control and the position of the variable primary coil until the station comes in loud and clear. These adjustments come with practice. The rheostat need be advanced only as the dry-cell A-batteries gradually drop off; never turn this rheostat higher than just necessary for good reception.

With ordinary use, the dry cells should last for several months, while the B-batteries will outlast several sets of A-battery cells and will need replacing about twice a year. The three tubes require but $\frac{1}{4}$ amp., and this drain on the dry cells is within practical limits for ordinary use. If, however, the filament switch is left on for long periods when the set is not in use, the dry cells will require frequent replacing. Those who desire may use a 4-volt storage battery and a B-eliminator with the set; standard 201-A, 5-volt tubes with a 6-volt storage battery may also be used, the screen-grid tube remaining as it is with the exception that a type 622 amperite must be used instead of the type 120. The 30-ohm rheostat should be



Two-Tube Screen-Grid Receiver

changed to a 20 or 25-ohm type for the larger tubes, or a type 1-A amperite may be used for each audio tube. If using larger tubes and a storage battery, the dry-cell space may be utilized to spread the baseboard layout in order to make room for a box shield for the coil.

The completed receiver together with the dry cells and B-batteries in either the one, two or three-stage type may be installed in a standard-size cabinet, as shown in the illustration at the left in the headpiece.

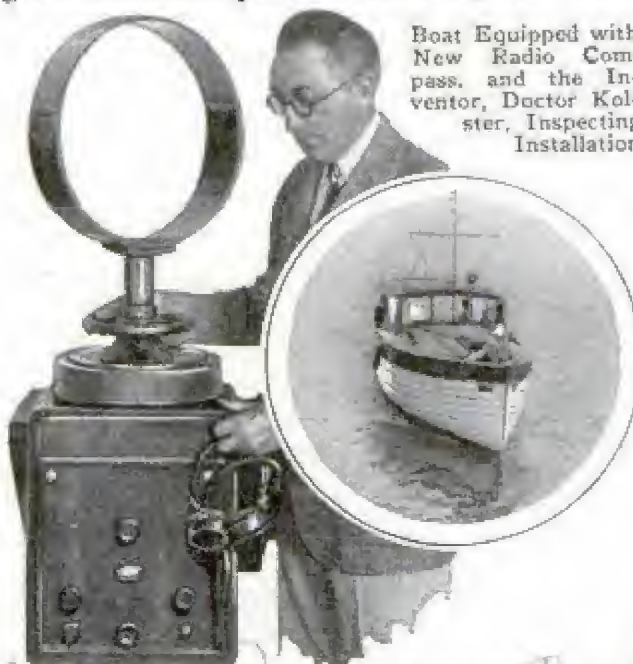
Blueprint No. 148, for this set, price 25 cents, from the Radio Department.

Radio Compass for Small Craft

A recent demonstration in New York harbor of a newly designed radio compass for yachts and small craft showed its efficiency in a unique test. A fog, seemingly made to order for the test, enveloped the harbor. The earphones of the instrument were given to the pilot, and to be doubly sure that he could not see, a handkerchief was tied over his eyes. With only the radio signals to guide him while lookouts watched for other

craft, the pilot held to his course for several miles through the fog, proving the dependability of this smaller type of radio compass. Three radio beacons send their automatic signals out over New York harbor and the water beyond for several hundred miles, just as other radio beacons protect all leading harbors all over the world.

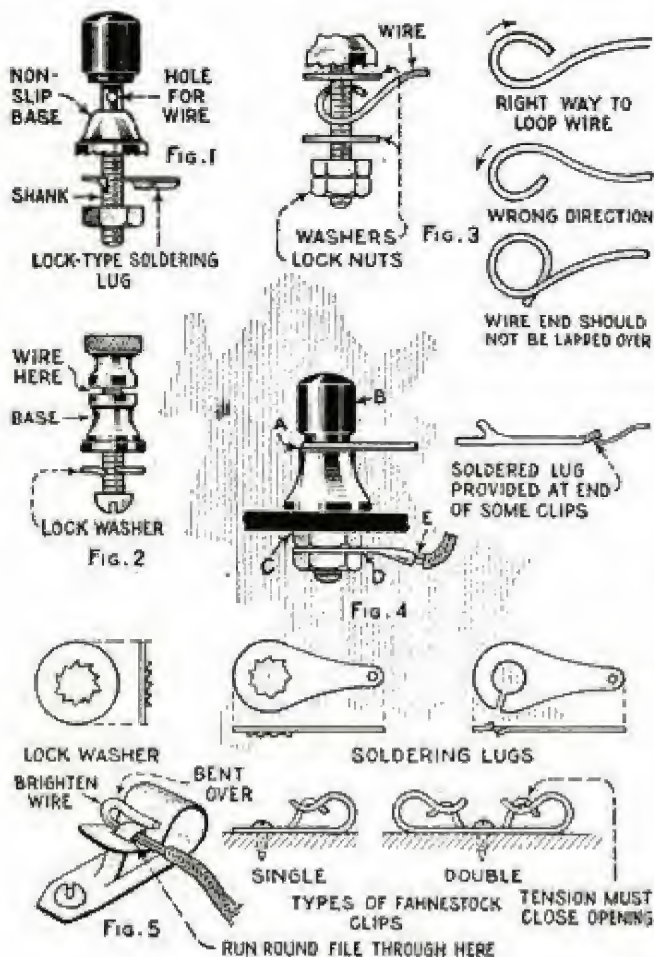
Boat Equipped with New Radio Compass, and the Inventor, Doctor Kolster, Inspecting Installation



¶ To test speaker windings, connect the speaker to the 110-volt a.c. line, with a 10-watt carbon lamp in series with the line, and listen for the hum.

Radio Compass for Small Craft

March 1934



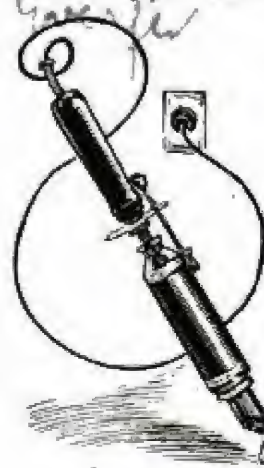
Good Connections Important

Few radio fans or service men realize the important part binding posts or connector clips play in the proper working of a set. Improper installation and poor soldering of these parts will seriously affect reproduction. When servicing a set, the first thing to do, after the power system has been found faultless, is to see that the connections to the set are in perfect condition. Styles in binding posts are many, but their fundamental construction is similar to those shown in Figs. 1 and 2. In Fig. 1, the wire passes through a hole in the stud and a knob is screwed down upon it to hold it tight. The base piece is crimped underneath, which prevents its turning on the panel or binding-post strip. Suitable nuts and washers below the strip or panel hold the stud from turning. Other binding posts of this type use a plain stud around which the wire is turned. The post shown in Fig. 2 employs a base piece in which is inserted a short stud on which the knob above is turned down. Underneath, the base is tapped for a machine screw. When installing the type in Fig. 1,

it is necessary to use at least one lock washer, or soldering lug with lock washer incorporated, to prevent the nut below from turning out and allowing the post to turn. If no lug is used, use a lock washer and two nuts below to thoroughly lock the base in position, as in Fig. 3. A lock washer or lock-type lug should also be used in post Fig. 2. In either case, if the wire is turned about the lug or screw, place it between the top lock washer or lug and the bottom of the strip. In every instance when the wire is turned about the post, loop it, clockwise. For quick and efficient connections nothing is so popular as Fahnestock clips; when using these, file all points of contact as in Fig. 5. They come in several types, both single and double, as shown in the sketches at the right. After long use, if noises develop in a set, examine the points indicated at A, B, C, D and E shown in Fig. 4 to ascertain if corrosion has taken place. When building a new set, as an extra precaution it is well to disassemble all binding posts and brush them with alcohol or gasoline to remove any grease or lacquer before mounting them in the set.

Soldering Iron Works like Fountain Pen

A soldering iron of the electrically operated type which differs materially from the usual device is shown in the illustration. Its distinguishing feature is that the solder is melted within the iron and flows to the point where it is controlled by a valve. This iron is made in three sizes and costs only a little more than the ordinary one.



Light-Socket Antenna Kink

To determine which of the two wires of the house wiring gives the best results for signal strength and selectivity, tune in a distant station and reverse the plug in the socket. The best position being determined, mark both so that this position may be maintained.

*Manual - by Feeding
from 204. 204. 204.*

Humless A-Eliminator for Radio Receiver

By MAXWELL P. GILLILAND

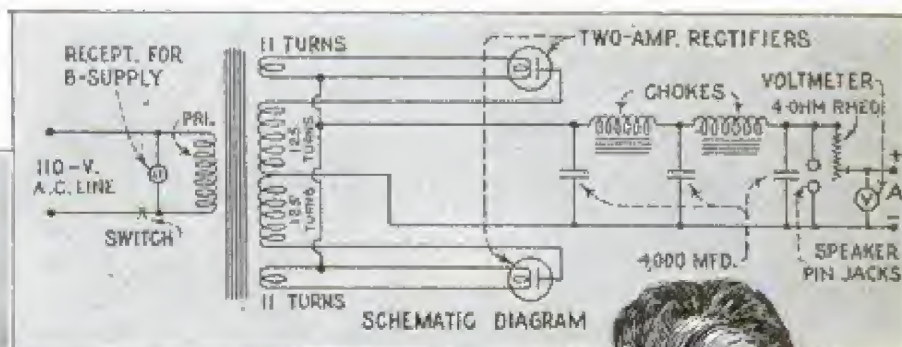
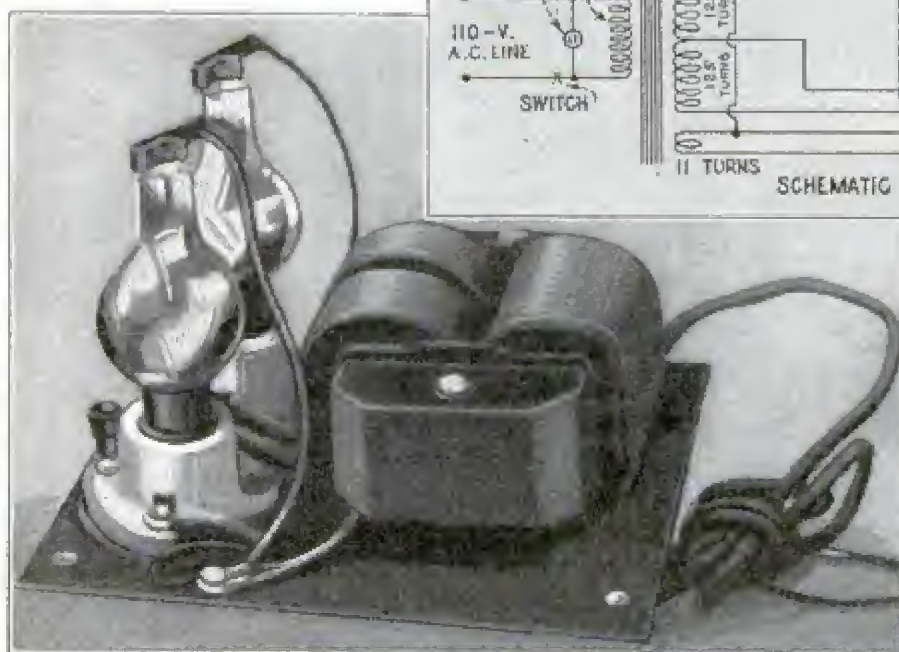
THERE are two things every radio enthusiast really desires: a perfect A-eliminator and the same kind of dynamic speaker. The A-power supply for the set enables the owner to operate his d.c. receiver in connection with a B-eliminator on the house-lighting circuit, retaining all the good characteristics of the tubes. This unit, being the hardest to get, is of course most desired. The average A-unit available today has a slight hum; though hardly noticeable, yet it is there. Responsibility for this defect is not directly traceable to any one part of the assembly as it is usually caused by a combination of several conditions.

As to the dynamic speaker, it is generally conceded that the battery-operated type is best, in that there is no hum as with the a.c. types employing the usual rectifiers. The hum in some types is more pronounced than in others, but in all cases it occurs when the set is not tuned in on a station. The a.c. hum is kept at a minimum by the use of audio-frequency chokes designed to operate in the neighborhood of 50 cycles. Unfortunately this has the

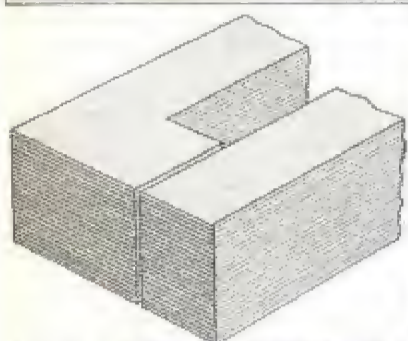
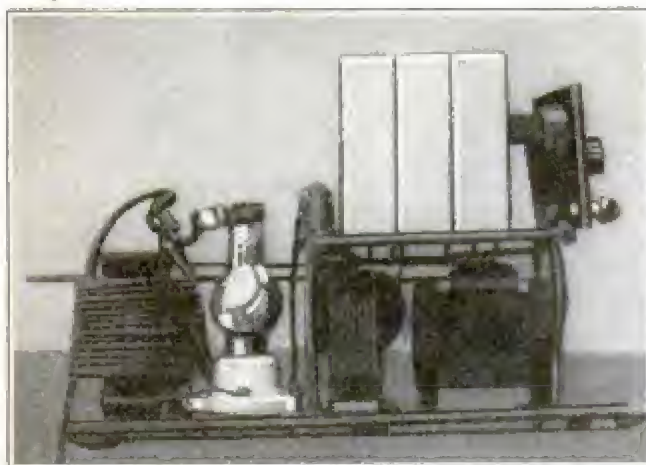
same suppressive effect on the lower notes. Many dynamic speakers employ a half-wave rectifier operating from a small step-down transformer to supply the voice-coil current, and as there is no filter to smooth out the current ripple, the result is the hum.

The d.c. dynamic costs less than the a.c. type, and if a source of pure d.c. at approximately 10 volts is available, both the receiver and speaker may be operated at minimum expense and maximum efficiency. Experimenting along this line led to the design and construction of the unit described and illustrated in this article, the result being an A-eliminator that fills the requirements without a hum.

After many trials, the writer has found that the only satisfactory method of obtaining pure d.c. for this purpose is to use tubes rectifying both halves of the 60-cycle a.c. supply. With large-capacity condensers and efficient choke coils, it is possible to maintain a constant potential and a very smooth current output.



Upper Right, Schematic Diagram of Connections; Below, Clamping Choke-Coil Assembly Together; Left, Transformer and Rectifier-Tube Assembly

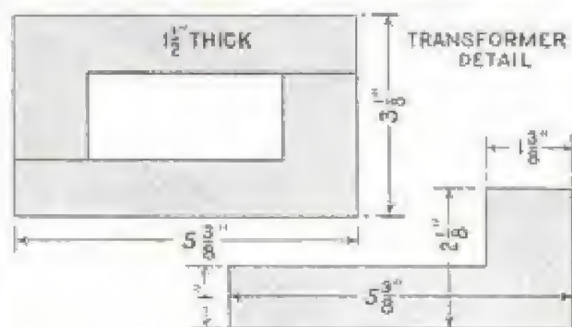
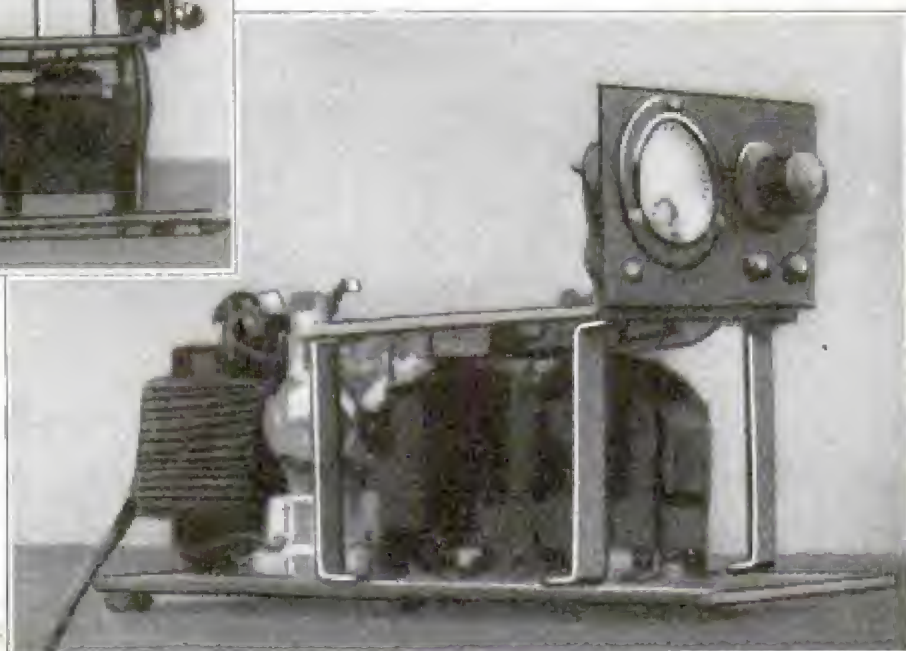


METHOD OF STACKING LAMINATIONS

Upper Left, Side View of Completed Unit; Right, Details of Panel and Platform Assembly

The transformer that supplies the tungar rectifier tubes must be carefully and generously designed; suitable apparatus may be purchased, but the average experimenter will prefer to make his own. A large amount of iron is necessary for the core; otherwise it will operate at too high a current density with little or no current regulation. Improperly gapped chokes saturate at very low current values. The chokes described have an inductance value of $\frac{1}{4}$ henry and are specially designed with heavy iron cores for use with the large-capacity filter condensers. The transformer is of the closed-core type, the details of which are shown on this page. The over-all dimensions are $5\frac{3}{8}$ by $3\frac{1}{8}$ by $1\frac{1}{2}$ in., and the laminations are cut and stacked in the manner shown. It will be noted in the diagram on page 1005 that there are four secondary windings, the outer two of which supply the filaments of the tungar rectifier tubes. The primary coil consists of 550 turns of No. 20 s.c.c. wire, layer-wound and placed on one leg of the transformer. It should be properly insulated from the iron core by means of "fish" paper or empire cloth, and wedged to the core so that no vibration will occur.

Each of the filament secondaries consists of 11 turns of No. 12 d.c.c. wire and are placed on either side of the plate windings on the other leg of the transformer. The coils supplying the higher plate po-



tential to the rectifiers have 125 turns of No. 16 d.c.c. wire. All of these coils are layer-wound and insulated carefully.

The choke coil details are shown on page 1007; the cores are $2\frac{3}{8}$ by $3\frac{7}{8}$ by $1\frac{3}{8}$ in., and the air gap, as indicated in the diagram, approximates .015 of an inch. Fish paper of this thickness is recommended for spacers between the legs. The winding is placed on one leg only and consists of 390 turns of No. 16 enameled wire.

The layout of the completed unit is clearly shown in the photos. It will be noted in the diagram that a receptacle has been provided for the B-supply, which is shunted across the primary winding so that both units may be operated by the same line switch.

To wind all coils, prepare wooden mandrels the size of each leg. A layer of

heavy cord is first wound on the mandrel, as shown in the upper sketch on this page. Next, over this, is placed a layer of insulating cloth or fish paper, then the regular winding of wire. Over each layer of wire place another covering of paper or cloth, and be sure that the insulating material is held firmly in place. To remove the coil from the mandrel, unwind the layer of cord. The core laminations should be stacked until the specified thickness has been reached, after which the laminations are bound together with a bit of tape. Over this, slip the finished coil, as shown in the sketch at lower right on this page, and wedge the coil into place with small pieces of the insulating material. The other leg of the transformer is assembled in the same manner, and the two halves of the core are then clamped by means of either wood, bakelite or metal strips, bolted together at top and bottom. In the case of the chokes, no winding is placed on the second leg.

Assemble the unit on a baseboard as shown in the photos; the two 2-amp. tungar tubes used are of the type usually employed in battery chargers and fit into ordinary screw-type porcelain sockets.

The filter condensers are of the new 4,000-mfd. dry self-healing type, the terminals of which must be correctly connected for polarity. The positive

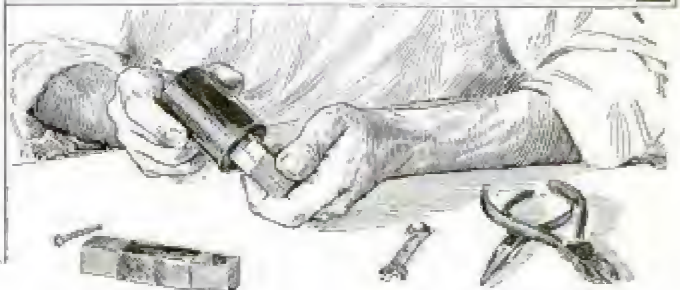
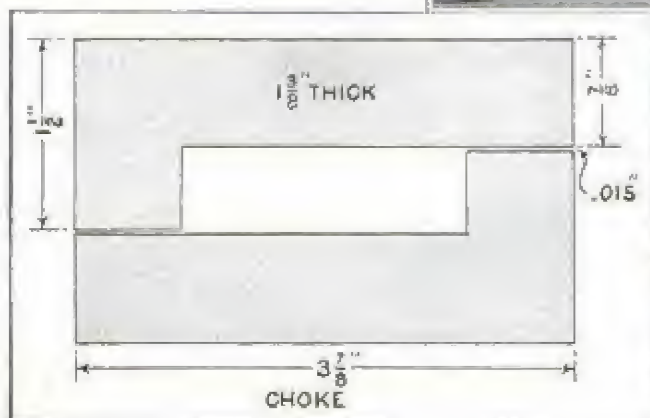
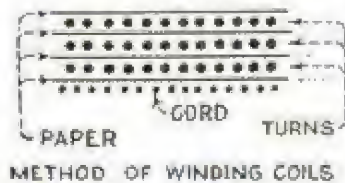
terminal is the red lead and the negative is black; these leads must not be reversed.

After the current is passed through the filter system, the output is pure d.c. at approximately 10 volts. This is carried directly to two heavy-duty pin jacks and two binding posts, as shown in the diagram. In series with the positive post, is a 4-ohm rheostat with a current-carrying capacity of 5 amp., and an 0 to 10-volt d.c. voltmeter is connected across the final output. The voltmeter is optional, but will be found very useful and, for best result, should not be omitted. The pin jacks are for the field or "voice coil" of the dynamic speaker. Very even and minute voltage adjustments may be obtained by means of the rheostat for the operation of practically any d.c. receiver. When, at the end of a year or so, the output of the tubes drops slightly, the rheostat may be set up a bit and things go on without further adjustment.

The rheostat, voltmeter, A-power supply posts and the pin jacks for the speaker field supply are mounted on a small bakelite panel with angle-iron brackets.

Blueprint No. 147, for this eliminator, 25 cents from the Radio Department.

Upper Right, Pointing Out Gap in Core of Choke-Coil Assembly; Below, Placing Coil on Core Leg



Making a Midget Multimeter

By WILLIAM H. WENSTROM

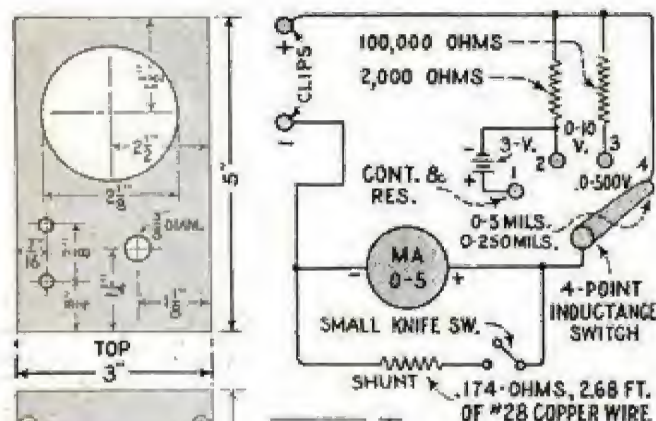


Fig. 2



tained miniature flashlight battery, it makes continuity tests and functions as an approximate ohmmeter for measuring external resistances between 100 and 50,000 ohms. It will not, of course, make alternating current and radio-frequency measurements; for these, separate instruments are required.

The following parts are needed for the instrument: 1 Weston, Model 506, milliammeter, 0 to 5 mils.; 1 four-point inductance switch; 1 miniature single-pole, single-throw knife switch; 1 resistor, 2,000 ohms, of the gridleak size; 1 five-watt resistor, 100,000 ohms; 1

Fig. 1

DETAIL OF CASE

RESISTANCE MEASUREMENTS			
MILS. CURRENT	EXTERNAL RESIST.	MILS. CURRENT	EXTERNAL RESIST.
1.5	0	0.7	2,300
1.4	140	0.6	3,000
1.3	300	0.5	4,000
1.2	500	0.4	5,500
1.1	700	0.3	8,000
1.0	1,000	0.2	13,000
0.9	1,300	0.1	28,000
0.8	1,850	0.05	58,000

TABLE 2

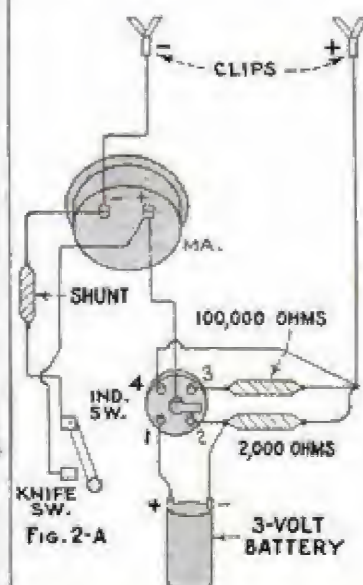


Fig. 2-A

THE ELECTRICAL or radio worker must have instruments for intelligent work; these instruments need not be expensive and soon pay their way in checking complicated circuits where an error may easily result in serious damage to costly apparatus.

In the midget multimeter described in this article, maximum usefulness has been combined with minimum size and cost, amounting to less than \$10. All apparatus is contained in a wooden case, the dimensions of which are 2 by 3 by 5 in. Yet it measures voltages through the ranges 0 to 10 and 0 to 500, and currents through the ranges 0 to 5 millamp. and 0 to 250 millamp. In addition, with its self-con-

KNIFE SW.	IND. SW.	RANGE	COR. FACTOR
OPEN	1	CONT.-RES.	SHORT 1.5 MILS
OPEN	2	0-10 V.	1.00
OPEN	3	0-500 V.	1.05
OPEN	4	0-5 M.	1.00
CLOSED	4	0-250 M.	1.00

TABLE 1 - RANGES

three-volt flashlight battery and a small wooden case of the size shown, made from 1/4-in. white pine. The connections may be made with ordinary hookup wire, and two small bulldog clips are employed at the ends of the flexible test-terminal leads.

The bottom of the case, detailed in Fig. 1, must be removable for battery replacement; the knife switch, milliammeter and inductance switch are mounted on a bake-

lite panel as shown in the photo. The shunt resistance consists of $32\frac{1}{2}$ in. of No. 28 silk-covered copper wire, which is wound on a wooden dowel, $\frac{1}{4}$ by 2 in., the ends of the fine wire being soldered to the ends of the larger connecting wires, and thrust through small holes in the dowel. The resistances and shunt are soldered directly to the connecting wires, without mounting clips; the resistances are both wound with friction tape to cover all bare connections, as they must be crowded into the box.

After all connections have been made, as shown in Figs. 2 and 2-A, the multimeter is calibrated against larger standard instruments, preferably of the accurate laboratory type.

Table 1 gives the various ranges and switch positions, and a like chart should be made up and glued to the side of the box. To calibrate the 0 to 10-volt scale, for instance, place the multimeter and a standard low-scale voltmeter across some given voltage, such as the filament of a tube which is in series with a battery and rheostat. If the standard voltmeter reads exactly 5 volts when the multimeter reads, say, 4.9 volts, a correction factor is necessary, and would, in this case, be 5 divided by 4.9 or 1.02. In other words, all multimeter readings on the 0 to 10-volt scale must be multiplied by 1.02 to give a true reading. The 0 to 500-volt scale is calibrated in exactly the same manner.

In calibrating the current ranges, the multimeter is connected in series with a standard milliammeter and a suitable current source. No correction factor is needed for the 0 to 5-mil range, as the milliammeter itself is very accurate. On the 0 to 250-mil scale, if the correction factor is less than .95, take a turn or two off the shunt; if the factor is greater than 1.05, add a turn or two.

For resistance measurements see table 2. The self-contained battery for continuity tests and resistance measurements is connected in series with the milliammeter and the 2,000-ohm resistor; a direct short circuit of the multimeter terminals shows a current of 1.5 mils. With table 2 the multimeter can be used as an approximate ohmmeter, measuring external resistances between 100 and 50,000 ohms with an accuracy of about plus or minus 10 per cent.

Of course, the battery must show very close to 1.5 mils on short circuit if this accuracy is to be maintained.

Handling Charged Filter Condensers

The high-voltage filter condenser is capable of holding a charge for a considerable length of time. Consequently shocks are possible if proper precautions are not taken when checking the modern power-supply unit. A simple method of avoiding such shocks is to make it a practice always to discharge such condensers before handling them. This is done by merely shorting the condenser terminals with a piece of wire, a screwdriver, or any other metal conductor.

Radio Set in Octagon Table Top 2422

The radio receiver shown in the illustration is a useful combination of a standard octagon table and a set with dynamic speaker. The antenna, ground and power connections are concealed in the table legs; there is no exposed wiring above the floor, and the table is wired for a lamp connection. All parts and tubes are



Hinged Top of Table Raised, Exposing Chassis of Receiver, and Home Installation

easily accessible for servicing by simply raising the hinged top of the table.

See page 62
Radio Receiver

Television Broadcasting in England

OFFICIAL television broadcasting is about to begin in Great Britain, operated on the Baird system which recently came through exhaustive tests before the postmaster-general and a parliamentary committee. Mr. Baird's results are said to be all that the average man could desire, except, of course, the absence of color, and a size, which has the appearance of being about one-third that of life.

The drawing on the opposite page features the scanning disk or "reproducing wheel" in particular, and the upper left units A, B, C and D show how the spots of light passing the spiral of holes completely traverse the subject. These sketches incidentally show the famous tobacco-smoke test, the graduations being transmitted with exceptional clearness.

The transmitting end of the apparatus is diagrammed below and the receiving televisior at the upper right in the full-page illustration. Certain secret details recently developed by Mr. Baird are not

brought out in the illustrations; for example, there is a double spiral of scarcely discernible holes in some of the disks employed, and a really efficient synchronizing gear is now operated at the hub of the scanning disk.

Some remarkable effects are produced by this television apparatus, as shown in the various sketches. When adjustments prior to transmission are taking place, effects known as "rain" or "confetti" may be seen in the televisior similar to those shown in Figs. 1 and 2. In the latter the image may be almost blotted out by a shower of spots of light. The subject, seated before the photo-electric cells at the transmitter in the lower illustration, experiences a dazzling sensation as the swiftly moving pencils of light traverse her face. The reflected light is converted into like current fluctuations by the photo-electric cells and broadcast as such, in the same manner as voice and music are handled by a microphone, and the sound

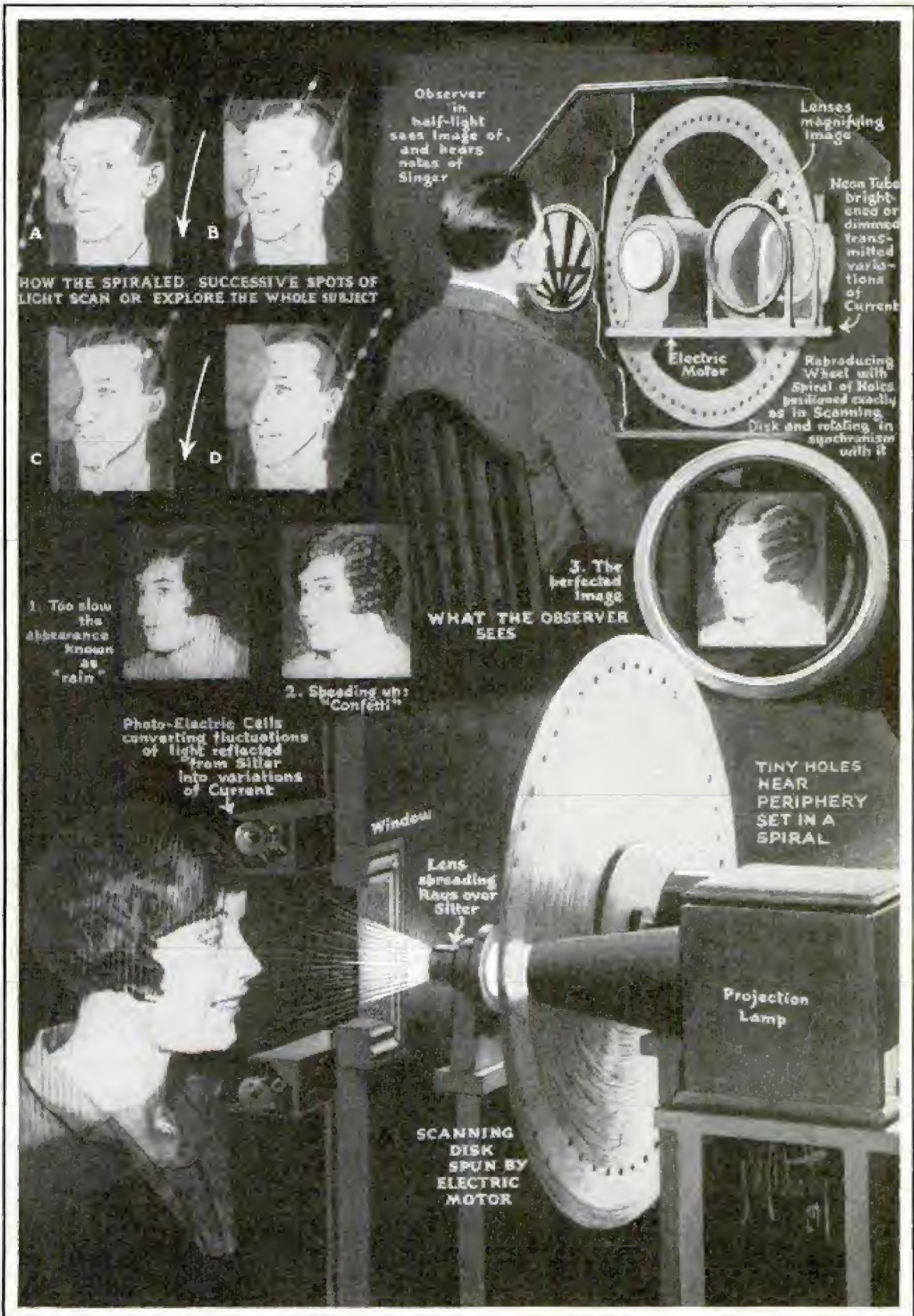


Left, Complete Television Receiver Soon to Be Seen in English Homes; Right, Rear View Showing Reproducing Wheel, Motor and Synchronizer



is transmitted as electrical impulses of corresponding fluctuations.

This "televisior" is the commercial installation that will shortly be seen in many English homes. Housed in a neat console, the apparatus consists of a suitable radio set, speaker for vocal announcements and regular broadcast programs as well as the equipment for picture reception. The images are viewed through the lens shown at the right, and the speaker grill is located at the left.

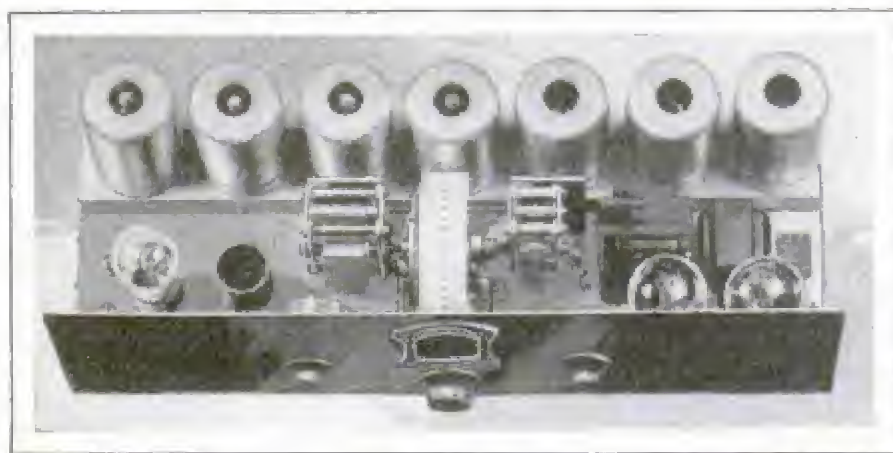


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Upper Right, Sectional Diagram Showing Television Receiver in Operation; the Observer Views the Image through the Lens at Right; Below, Transmitter, Showing Pencils of Light Traversing the Subject Transmitted to the Receiver Above

Receiver Employs Five Screen-Grid Tubes

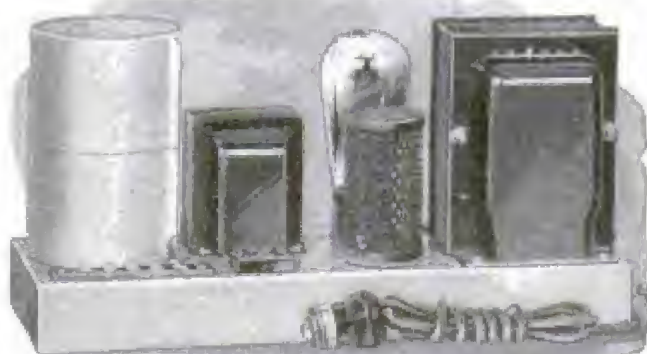
The ten-tube receiver shown in the upper photo is a powerful custom-built as-



Upper Left, Receiver Ready for Installation, Showing Compact Assembly; Below, Power Unit

sembly, employing five type-224, three type-227 and two type-245 tubes. The power unit below is a specially designed instrument, the filter system of which is equipped with a heavy choke and the new self-healing condensers of 24-mfd. capacity. An automatic line ballast and regulator levels out all fluctuations in line voltage from 95 to 130 volts. This line regulator may be switched out if not required; a type-280 rectifier tube is employed in the power unit. The receiver is very compact and is designed to fit current models of fine consoles. The amplification system is built around the new a.c. screen-grid tubes, the amplification factor

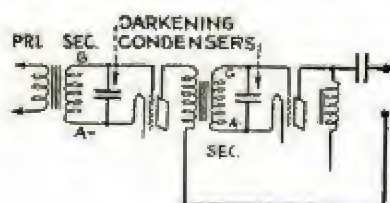
of which is exceptionally great. This tube is especially adapted to the intermediate-frequency stages of the superheterodyne receiver. Since they operate at only one frequency in this circuit, all tendency toward oscillation is eliminated. One of these tubes is the detector upon the plate of which is impressed 175 volts. This new system of power screen-grid detection prevents overloading the detector, even at maximum. A plug-in



jack is provided for the instant attachment of an electric phonograph pick-up system. The entire audio system is used for this purpose. Good selectivity and coast-to-coast range combined with humless a.c. operation are claimed for this new receiver.

Bringing Out the Bass Notes

The diagram shows a simple and effective method of bringing out the bass notes that add so much to the quality of any program. The "darkening" condensers placed across the secondaries of the a.f. transformers may be any good fixed type, and have the effect of lowering the frequency of the



coils to favor the low-frequency bass notes. As it is advisable to try a number

of different capacities, condenser mounting brackets should be provided to make

possible quick change of values. Transformer characteristics vary considerably and hence no set values can be given, but the proper capacities will be somewhere between .0005 and .006 mfd.

Cleaning Tip of Soldering Iron

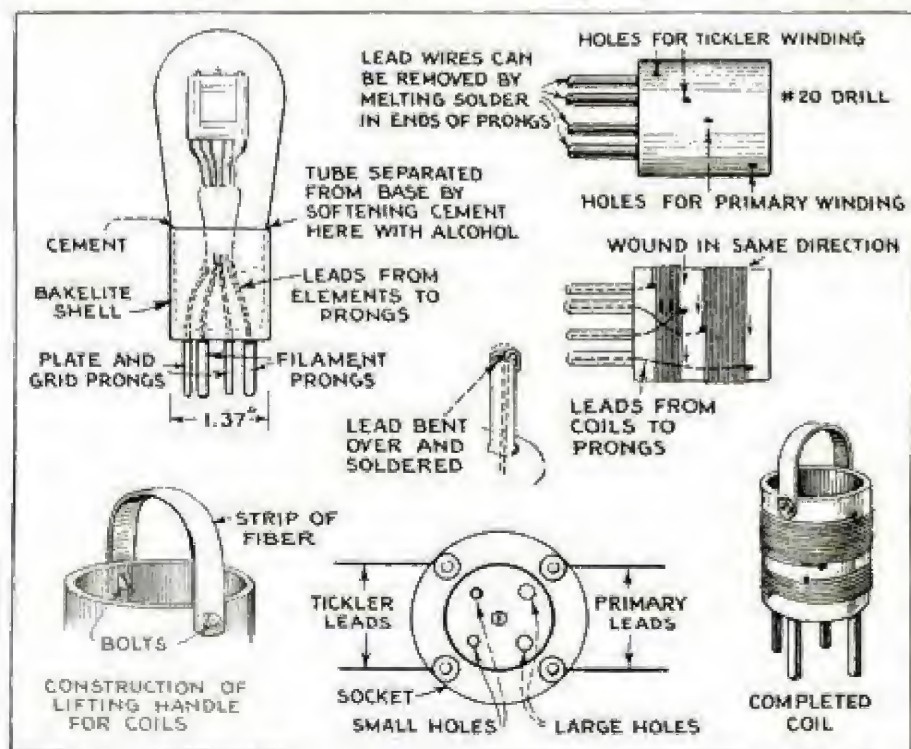
Good work cannot be done with a soldering iron that is not kept clean and well tinned. A small wire brush is useful for cleaning the tip of the iron before tinning. A woolen cloth or asbestos pad should be used to keep the point clean.

Popular Mechanics radio department offers its information service free to all readers of our magazine.

Plug-In Coils Wound on Tube Bases

The use of plug-in coils, especially with short-wave receivers, is increasing. Many experimenters would like to make their own, but are deterred by lack of the necessary construction details. This article illustrates and describes a simple and inexpensive method of winding coils of this type, employing the bases of old tubes for the necessary plug-in forms. Choose tubes having bases as long as possible. Old rectifying tubes and power tubes have longer bases than ordinary receiving tubes, and burned-out tubes of this type may often be obtained from the local service man or dealer. The tube may be removed from the base either by painting the cemented joint with alcohol or by immersing the base in warm water until the tube is loosened. When employing the latter method, be careful that the water is not too hot or the base will be damaged. When the tube is loose, heat the ends of the prongs with a soldering iron, and the tube and leads may then be lifted clear. Turn the tube base over and drill out the prongs for a clear passage. The four small holes for the tickler and primary windings are then drilled in the side of the base, as shown in the construction diagram. The writer uses No. 28 enameled wire

for winding all coils down to those for the 20-meter band. As the higher frequencies are approached, however, better results are obtained by using d.c.c. wire of a larger diameter, such as No. 22. For the tickler coil, a bared end of wire is inserted in the bottom hole in the tube base, passed down through the prong and bent over as shown. The end of the wire is fastened in place with a drop of solder, which is then filed down in the same manner as on the tube. The tickler coil is now wound tightly and clamped to the base, and the upper end of the bared wire passed through the second hole and prong and served as before. The primary winding is done in the same manner. It will be noted that the two large prongs are always used for the tickler leads and the slender ones for the primary leads. When connected in this manner, the coils will all be alike and work satisfactorily in sockets where like connections are made. When complete, file away all excess solder and brighten the prongs to make good



Above, Detailed Construction Diagram; Left, Painting Tube Joint with Alcohol to Loosen Cement; Completed Coils Ready for Lifting Handles

contact in the socket. Two holes are then drilled in the top of each coil form to take short 6-32 machine screws for the lifting handles. These handles may be made from strips of fiber, drilled and bent to form bails as shown, and are held by the machine screws and small hexagon nuts on the inside of the form. A table of turns for the various wavelengths is

rather difficult to give, owing to varying condenser capacities employed in differ-

trouble. In many instances, the loss in sensitivity may be traced to changed resistance values, usually upward rather than downward. Since the sensitivity of the circuit depends upon constant and definite resistance values, the answer, of course, is new resistors.



Soldering the Projecting Leads to the Prong Tips

ent circuits. With a five-plate wavelength condenser and one of eleven plates for regeneration, the writer employs coils of the following turns with good results: For the 150-meter band, tickler, 42 turns and secondary, 18 turns; for 80 meters, tickler, 22 turns, secondary 12 turns; for 40 meters, tickler, 9 turns, secondary, 10 turns. For the 20-meter band use No. 22 d.c.c. wire, employing 7 turns on the tickler coil and 4 turns on the secondary coil. For the 10-meter band use 5 turns of the same size wire for the tickler and 3 turns for the secondary. These coils cover each band, overlapping above and below to cover the entire short-wave range.

Regaining Lost Sensitivity

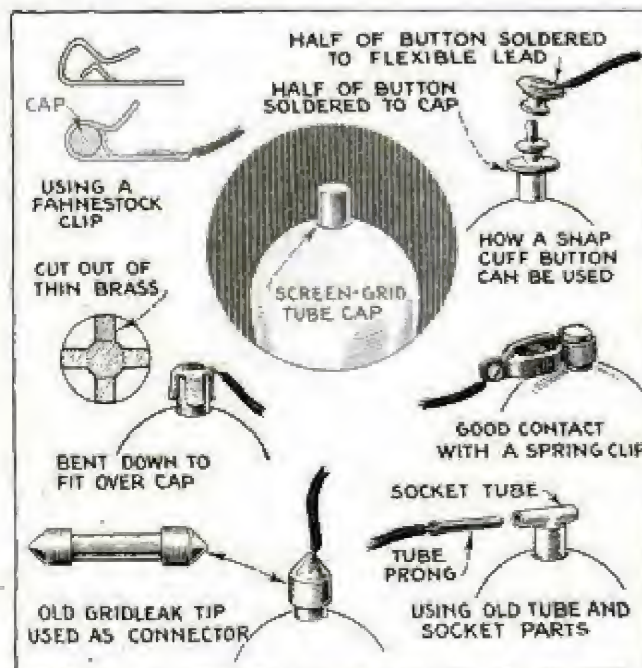
Many old sets are discarded because of lost sensitivity, and when the set begins to lose its ability to bring in the distant stations, the owner usually buys new tubes and batteries, which may or may not remedy the

New Television Scanner Employs Shutter

A combination scanning drum and selector shutter has recently been demonstrated by the Jenkins Television corporation engineers. The new arrangement takes the place of the former scanning drum with the light-conducting rods and four-plate neon glow lamp. It is claimed to be more efficient and to give better detail and illumination than the former device. Silhouette transmissions appear with sharp black-and-pink definition, and half-tone pictures are also handled with good results. The use of the selector shutter in combination with a standard neon tube and a small scanning drum, so that the drum rotates four times in flashing each 48-line picture, results in retaining the compact dimensions formerly obtained, yet the equipment is reduced to the simplest and most economical terms.

Emergency Clips for Screen-Grid Tubes

Experimenters with screen-grid tubes will often find themselves in need of clips for the control-grid cap. Six emergency clips for the tube caps are shown in the sketches and have been found to meet the requirements. The materials are to be found around any experimenter's work table and the cost is practically nothing. The always adaptable Fahnestock clips, snap cuff buttons, small spring clips and ends of grid-leaks, also are good material for clips.



Various Ways of Making Clips for Control-Grid Caps from Odds and Ends



Easy Chemical Tricks

By SAM BROWN

*151 Carhart St
Marion Ohio*

MAGIC has many divisions. That section dealing with tricks based on chemical reactions contains a wide variety of novel and excellent effects, and

The chemical agent in this effect is that simple preparation called collodion. The sugar is previously dipped into this solution. This must be done rapidly, and the sugar should be held there for only an instant. After the dipping, the sugar should be allowed to dry for about 24 hours.

The prepared lump, when dropped into the coffee, will sink instantly, but, as the sugar dissolves rapidly, the



Above, the Mysterious Sugar Cube Bobs to the Surface; Right, Parlor Fireworks from an Orange Rind and a Candle

the little preparation necessary for the presentation of these mysteries is well worth while.

First, "The Ghost Sugar." In this effect, the performer drops a lump of sugar into his coffee. It sinks to the bottom of the cup immediately, and in a manner thoroughly unmagical. But, wait! Presently the sugar bobs up on the surface, where it floats around buoyantly and smiles sarcastically at an amazed audience.



framework of collodion will presently bob up on the surface of the coffee. I might say, in passing, that the collodion lump should not be left about, for its appearance is quite like any other lump of sugar, and someone might—oh, well!

Why wait for the "grand and glorious Fourth" to have fireworks? If you will take a thick orange peel and squeeze the juice from it into a candle flame, you will witness a pyrotechnic display of golden stars which is entirely out of proportion to anything so plebian as "just a rind."

In the next effect, the performer exhibits an ordinary moth ball. He drops the ball into a glass of water. It sinks. Then, on command of the performer, the moth ball rises to the surface of the water.

On a further command it goes to the bottom again, then, finally, to the top, when it is removed by the magician and passed for inspection.

Really, there's nothing to it. The moth ball is simply a moth ball; the water is carbonated water procured from the corner drug store. When the moth ball is dropped into the water, it naturally sinks to the bottom. At the bottom of the glass, however, it breathes gas from the carbonated water, and presently becomes light enough to bob its way to the surface, only to sink again as the gas escapes. The magician need only time his commands to synchronize with the chemical reaction—and there you are!

Did you ever happen to hear the story about the girl and the magic candle? Well, anyhow, the candle went out, and left the girl in fearsome darkness. "Oh, dear me," she wailed, "what'll I do?"

And then she remembered a fairy story, and, touching the candle wick to the edge of a glass of water she was carrying to her sick grandmother, she received her flame back again! No fooling!

That last is the "patter"; the actual trick is done with a small piece of phosphorus about the size of a pinhead. This is stuck to the rim of the glass with a minute piece of tallow. When the hot wick of the candle touches the phosphorus, it



The Obedient Moth Ball Obeys Its Master's Voice; Lighting a Candle from a Glass of Water; Right, It's Easy to Ignite Sugar

ignites immediately and lights the candle. At the instant of lighting, the tumbler should be tilted so that the candle appears to be relighted from contact with the water. Phosphorus, by the way, should be kept moist when not in use, as it ignites with extraordinary quickness at a comparatively low temperature.

The average person imagines that lump sugar being almost pure



Top, Right, Making a Soap Bubble Go Boom and "Faw Down"; Below, If You Have No Matches, Be Nonchalant, Light the "Cig" with a Piece of Ice

carbon, will burn readily, but, fact is, it does nothing of the kind; it merely melts away when a lighted match is held under it. Of course, if you are a magician—well, you know how clever some people really are!

The secret is simple. The sugar must be previously casually rubbed into some cigaret ash, and the ash, adhering to the lump, will give it sufficient "timber" to burn readily.

Did you ever hear a soap bubble go "bang"? Go on! How could the gossamer sheen of a soap bubble go bang? Well, here's the how. Take a bubble pipe and wad a small sponge soaked with gasoline inside it. Fumes from the gasoline will be largely the contents of the bubble; and when held near a candle flame, these bubbles will explode with a quaint bang which is quite mystifying.

In the next number, the performer dem-

onstrates just how convenient it is to be possessed of the magical touch. With no matches available, the magician lights his cigaret from a piece of ice which he has removed from the iced tea. How's that for service?

Of course, no one is supposed to know that his cigaret has been previously treated, and that a small bit of potassium has been inserted in one end, as shown in the sketch. When the potassium comes in contact with the wet ice, it instantly ignites, and lights the cigaret.

Must I say it? Be sure you know which end of the cigaret is which, before you proceed with the nonchalant gesture.

□ When a copper-lined or porcelain tank for cold water leaks from small holes, dry off the surface thoroughly with a rag; then locate the leak, and pour hot paraffin or drop wax from a candle on it.

Tractor Used as Locomotive

Equipped with four large flange wheels to fit regular railroad tracks, an ordinary



Gasoline Tractor, Equipped with Flanged Wheels to Fit Railroad Track, Serves as Locomotive for Hauling Cars of Dirt and Stone

gasoline tractor was transformed into a small locomotive and was found highly satisfactory for hauling cars of earth and rocks. As a tractor usually has only two drivewheels, side rods are used to provide all the wheels with equal tractive power. A pipe frame covered with canvas protects the driver or engineer from the weather.—Carlton Groat, Portland, Oreg.

A Green Lawn without Grass

From a distance, the front yard shown in the photo looks like any other well-kept lawn with grass, flowers and shrubs, and only a close view shows that the lawn is in reality rough cement painted green. Cement is used instead of sod for reasons of



California Home Owner Has Green-Painted Concrete Lawn Resembling Grass

economy, as the cost of water for irrigation in this locality is too expensive.—George B. Bowers, San Diego, Calif.

Eradicating Poison Ivy

Poison ivy can be eradicated by spraying with low-grade kerosene, which suffocates the cells in the plant tissue and causes destructive chemical action. Higher grades of kerosene are not so effective for the purpose as they are too volatile. The treatment preferably should be applied in hot weather when the soil and air are dry. Crude oil will serve equally well. Repeated cutting of the plant close to the ground facilitates destruction through starvation. The cutting causes the plant to use up all the food stored in its roots and, due to the withering of the foliage, it cannot provide new food for regrowth.

Insulating an Electric Extension Cord

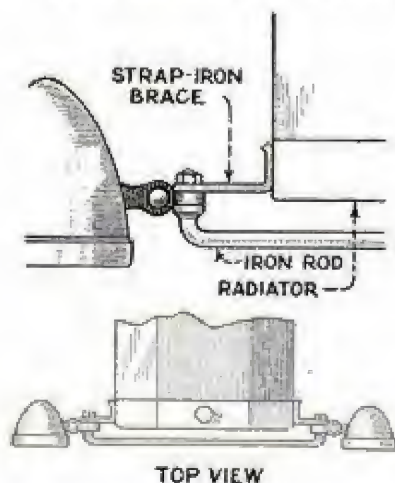
Dangerous electric shocks are often occasioned by handling extension cords in basements. To prevent this, the metal sockets are sometimes covered with friction tape. It is necessary, however, to continue the wrapping of tape on the cord, especially near the socket and plug ends, where the wire is likely to wear quickly, owing to constant bending and

strain. A better method of insulating the extension cord is to get a piece of rubber tubing of the same length as the cord and slip it over the latter. Use a rubber plug and an insulated socket and then bind the ends of the tubing to the plug and socket with friction tape, in order to prevent the entrance of water. A cord covered in this way is easy to handle, will not kink and is safe to use anywhere, even in a flooded cellar.

Brads Steady Small Pictures

Wall pictures, especially small ones, often hang crooked, not because they were hung so in the first place but because of vibration of the building. To eliminate the necessity of daily readjustment of the pictures, drive a small brad into each of the two lower corners of the frame, on the back. The heads are then cut off with a pair of wire cutters, leaving a sharp point. The brads should not project more than $\frac{1}{8}$ in., and the points can readily be pressed into the surface of the wall so as to hold the picture level.—Douglas Leechman, Ottawa, Can.

Anti-Rattler for Front Auto Fender



You can prevent the front fenders of certain types of small cars from rattling by installing two small pieces of strap iron as shown in the drawing. The strap iron should be about $\frac{3}{16}$ in. thick and the pieces about $3\frac{1}{2}$ in. long. They are bent at right angles, and a hole is drilled at the outer end, to fit on a lug of the lamp bracket. The installation shown was made on a Chevrolet of the 490-type. Before drilling the holes, place the pieces beside the radiator shell so that they will spring tightly against it after they have been attached to the lamp-bracket lug.—Guy E. Clark, Everett, Wash.



Old Bathtub Sunk into the Earth Makes a Good Fish Pond

Old Bathtub Makes Fish Pond

The photo shows a practical fish pond which consists merely of an old bathtub sunk into the earth. It is the idea of Loren Grey, twelve-year-old son of Zane Grey, American novelist and sportsman. A 4-in. layer of sand was spread over the bottom and suitable water plants were added to make the pool attractive.

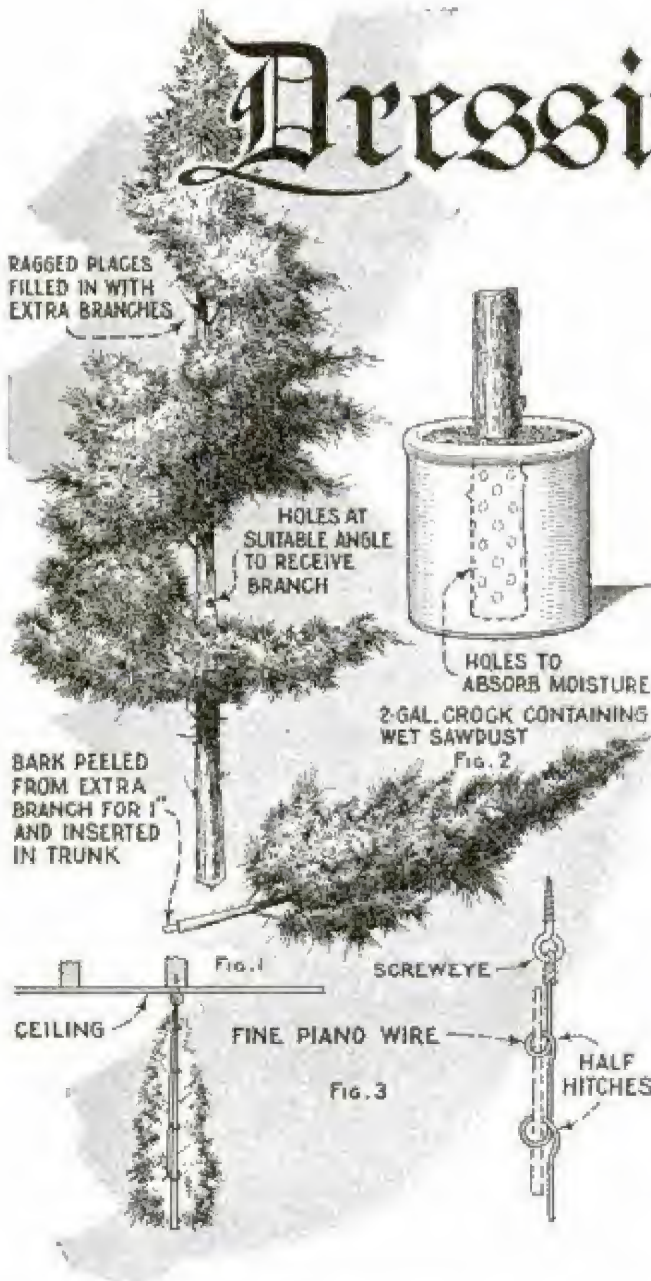
Fingerprint as Check Protector

Fingerprints make excellent check protectors. Merely press your thumb on a stamp pad and make an impression over the figures denoting the amount of the check, as shown in the drawing. It will be very difficult for anyone to change the figures without any trace of the attempt. Those who do not feel justified in purchasing a mechanical check protector will find this method very satisfactory, and the expense is negligible.



Dressing Up the

By Dick Cole



applying a little ingenuity you can shape almost any tree into a perfect cone. To do this some extra branches are necessary. If these cannot be obtained, it is well to buy a second cheap, misshaped tree, and use its branches for making one good tree.

Wherever the branches of the tree are sparse, extra branches are used to fill in. One of these is cut to suitable length and the bark peeled off the thick end for about 1 in. A hole the size of the peeled branch is bored in the trunk of the tree and the branch is inserted. It should fit tightly, but glue is not necessary. Of course, care should be taken when boring the hole so the branch will fill in where needed. Fig. 1 shows how this "grafting" operation is done.

Often the lower branches of a Christmas tree droop. This irregularity is remedied by holding up the drooping branches with lengths of fine wire or thread attached to the middle of the branches and to a higher point on the trunk. Fine enameled wire is almost invisible when used for this purpose, although several lengths of dark-green silk thread will serve.

After the tree has been shaped, the next operation is to set it up. There are many patent stands for Christmas trees, but unless they have a very wide base or are screwed to the floor, the tree can easily be tipped over. Where there are little children in the home, their curious fingers are bound to reach for the glistening ornaments, and an upset tree is a common consequence, sometimes with disastrous results. This danger can be avoided by suspending the tree as is shown in Fig. 3.

A long, slender screw-eye is driven into an overhead rafter. If a small drill is used to pierce the plaster, no disfiguring mark will be left when the screw-eye is removed. A length of fine piano wire is attached to the screw-eye and led down the trunk of the tree with a series of half hitches. This

THE ANNUAL dressing up of the Christmas tree can either be a mediocre job or a work of art. During the holiday season you see hundreds of trees posed in the front windows of residences. Many you pass by without a second look. They are mere commonplace Christmas trees, loaded with tinsel and gaudy baubles. Other trees compel attention. They fascinate the eye. It is not the tinsel and baubles and glamour that hold the attention, but the symmetry, the color harmony and the background.

To decorate a tree, the first requisite, of course, is the tree itself. Sometimes it is difficult to obtain a perfectly symmetrical tree of the size you require. The tree may be ragged on one side, or the layers of branches may be too far apart. But by

Christmas Tree

method offers another very good feature, namely, means of watering the tree. Every one knows that, in a heated house, a Christmas tree soon dries out and the needles fall. But if the base of the tree is submerged in water, the tree will live for months, and with the tree suspended, it is a simple matter to place a crock or jar under its base. Rather than filling the crock with water, which might be slopped over, it is better to pack the space around the base with sawdust or sand and keep it wet. It is also well to bore a few radial holes in the base so that water can reach the heart of the trunk, as in Fig. 2.

You are now ready to string up the lights. These are the bugaboo of many Christmas-tree decorators. It is quite troublesome to locate a burnt-out lamp because the bulbs are wired in series, that is, the current passes out of one light into the next throughout the string. If any one lamp burns out it opens the circuit on all the others. Each lamp must then be tested separately to locate the bad one, which often means getting out the stepladder and disturbing the fragile ornaments. This trouble can be eliminated. It is customary to use two, three, four or more strings of lights on a tree, and by rewiring these into a system called "series-parallel," a warning is immediately given if a lamp burns out, and the bad lamp can instantly be located and replaced. Figs. 4 and 5 explain this method of wiring.

First one must prepare the leads to the lamp sockets. These vary in length to conform to the conical shape of the tree, the longer leads being at the bottom. In the case of rewiring four strings of lights, prepare four sockets with 8-in. leads; four each with 12, 16, 20-in. leads, and so on up to 36 in. Additional wire will be necessary, and a good, well-insulated kind should be used.

After the eight sets of sockets and leads are ready, cut off eight 1-in. lengths of $\frac{1}{4}$ -in. fiber tubing. Drill two sets of four holes in each piece as shown in Fig. 5. The leads to each socket of a set are drawn into these holes—one wire in the top hole, the other wire in the corresponding bottom hole. The wires are then poked out through the nearest end of the

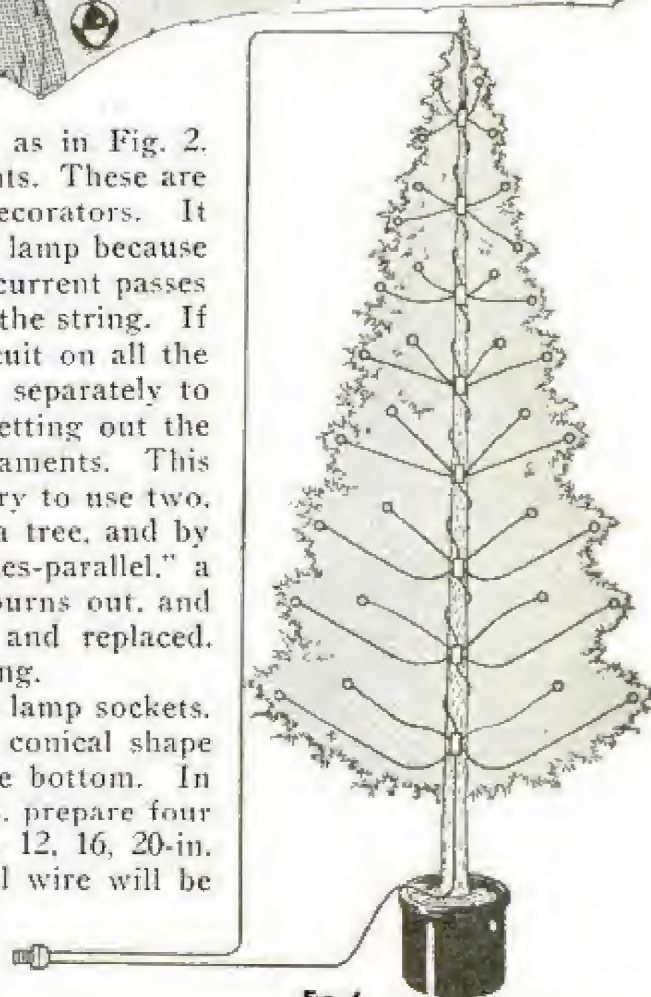


FIG. 4

fiber tubing and are twisted together. When the eight groups have been prepared, they are joined with 12-in. lengths of ordinary insulated wire. The connections should be soldered, taped, and then forced back into the tubing to make a good-looking job.

In use, the main feeder is stretched along the trunk of the tree with an occasional wind around it. The leads to the lamps can be twisted around the stems of the branches so as to be almost invisible. With the ordinary Christmas-tree lights, the wire must be draped from branch to branch in an unsightly manner.

After the strings of lights have been wired into series-parallel, if one lamp burns out, the other three of the group will brighten up considerably, while the remainder of the lights on the tree grow dim. The fourth lamp of the bright group is, of course, instantly recognized as the bad lamp. The series-parallel wiring should not be applied to less than three strings of lights. Four strings are better. Even though this rewiring may take a little time and money, the result obtained is well worth it. When the tree is finally taken down, the string of lights can be stored away and used year after year. The first cost is the only one.

After the lights have been installed on the tree, there are many ways of proceeding with the decorating. The common way is to drape the tree with tinsel cord, and to hang shiny, colored ornaments here, there and everywhere. Perhaps "barber-pole" candy canes and over-stuffed netting stockings add to the miscellaneous decorations. The result is just an ordinary Christmas tree like thousands of others. But a tree decorated according to the following directions will be different. It will be one of those exceptional trees which commands the attention of the passer-by. Just as it will be pleasing to those without, so it will be pleasing to those within.

The first operation is to spray the whole tree with thin varnish. Any varnish thinned down with turpentine will do. A "fly-tox" sprayer will also serve as a varnish sprayer. During the spraying, it is well to surround the tree with an old bed-sheet or with sheets of wrapping paper, so that the varnish mist will be confined

and will not settle on the furniture and drapery of the room.

After the branches have been thoroughly sprayed, cornstarch is sprinkled over the tree. The best way is to use a flour sieve above the topmost branch, and allow the starch to settle softly on the upper side of the branches. During this operation there should be no draft through the room. After a few minutes, the tree is again sprayed and again "starched." These operations are repeated until a sufficient bank of "snow" has been built up on the branches. Then,

after a final spraying with varnish, flake mica is sprinkled over the tree. The flour sieve cannot be used for this purpose. The mica must be sprinkled gently from the hand. So-called "imitation snow" is flake mica. Some of the powders used in tire casings are finely crushed mica and can be used. Of course, it must be the glittering kind.

The lamps should be in the sockets during the varnish spraying, and immediately afterward be wiped off with a rag dipped in turpentine. If the sockets are left open during the spraying, varnish may enter and will

act like glue when the lamp is screwed in.

Tinfoil "icicles" add a pleasing effect to any tree and should be used freely. These should always hang straight; never be draped from branch to branch. If the narrow strips of foil are twisted, a better effect will be obtained from indirect lighting. A reasonable number of spherical ornaments are now hung from the branches and spaced symmetrically about the tree. Use mostly colorless ornaments with a mirror surface. Ample color will be provided by the color scheme to be described later. If you can obtain some glass prisms such as were used on the old-time lamp in the parlor in pre-electric days, they can be used to good advantage on a Christmas tree. With indirect lighting, the prisms reflect all the colors of the spectrum.

All of the foregoing decorating sugges-

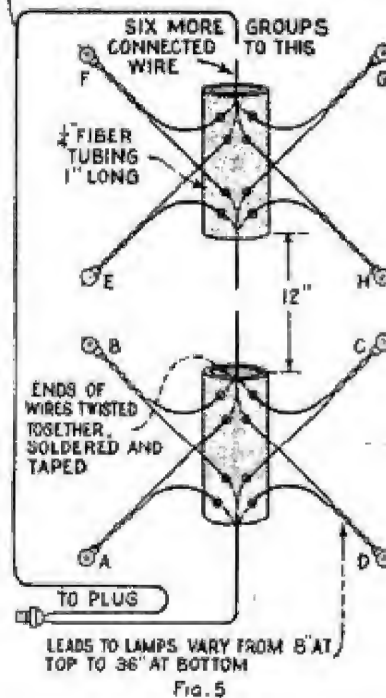


FIG. 5

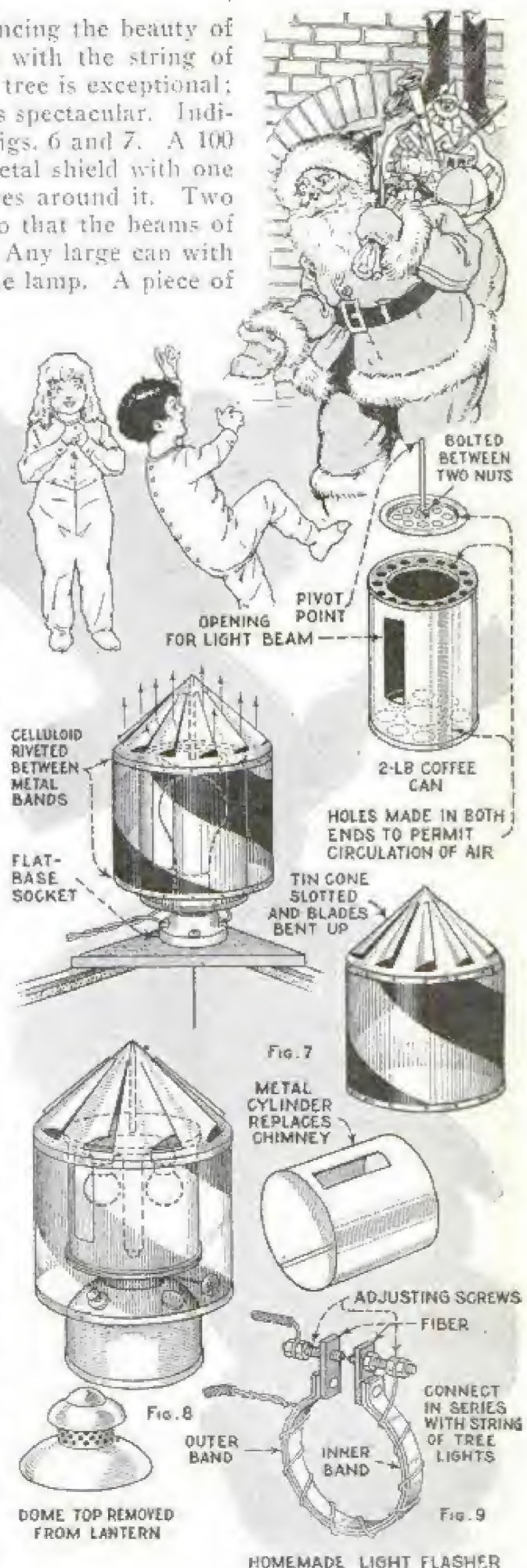
tions have been made with a view to enhancing the beauty of the tree with indirect lighting, as well as with the string of lights. With the string of lights alone, the tree is exceptional; with indirect lighting and color screens, it is spectacular. Indirect lighting is very easy to install. See Figs. 6 and 7. A 100 or 150-watt lamp is fitted within a sheet-metal shield with one narrow opening, and a color screen revolves around it. Two of these fixtures are used and are placed so that the beams of light fall upon the tree at an acute angle. Any large can with a removable lid will serve as a shield for the lamp. A piece of $\frac{3}{16}$ or $\frac{1}{4}$ -in. rod, about 3 in. long, is threaded at one end and fastened to the center of the removable lid with two nuts. The other end is tapered off to a sharp point to act as a pivot point for the revolving color screen. As many holes as possible should be cut in the top and bottom of the can to allow free circulation of air. Make a very small slot in the side of the can first, then, after the fixture is in place, enlarge the slot until the beam just floods the tree.

A cone is made from ordinary tin. The face of this is slotted, and sections are bent up to form fan blades. A cylinder of colored celluloid is suspended from the rim of the cone. It is best to use the primary colors—red, yellow and blue. Note that the color bands are in a spiral around the cylinder. This gives the effect of the changing colors settling down on the tree instead of flashing on it.

It takes from five to ten minutes for the lamp to become hot enough to establish air circulation through the can. The flow of hot air is very trifling, in any case, so the pivot point must be made as sharp and frictionless as possible.

Since there is no synchronization of the color screens, they will not revolve at exactly the same speed. Thus the blending of the primary colors will produce nearly every tint of the color scale. The effect is fascinating. Particularly the violet tint on the imitation snow.

In rural districts where electric light is not available, revolving color screens can be used with gasoline lanterns. The mica chimney is replaced with a slotted sheet-metal cylinder. The dome top is removed to give better air circulation. It is also necessary to remove the handle. See Fig. 8. As celluloid is highly inflammable and a gasoline lantern gets rather hot, it is best to leave a space of at least two inches between the celluloid and the metal sleeve.





Colored celluloid may be difficult to acquire in rural districts. But old 8 by 10-in. negative films can be procured from the town photographer. The emulsion can be washed off and the film colored. Common glue, thinned out with hot water and colored with red, green or blue ink, will make a very good temporary color film on the celluloid. It will pass much more light than the so-called "color varnishes."

A homemade thermostatic flasher for a string of lights can easily be made, as is illustrated in Fig. 9. The drawing explains the operation. It might be well to mention that fine iron wire can be used

in place of nichrome wire, and ordinary iron or brass screws instead of the contact adjusting screws from a distributor. However, the use of the former makes frequent adjusting necessary, as the soft points burn away when the contact is broken. The operation of the flasher should be obvious. When the screws are in contact, the current passes through the resistance wire wrapped around the ring. As the ring heats, the aluminum band expands more than the steel and the contact is broken. The wire then cools down, and the contact is re-established.

Rubber Band for Model Airplanes

Often the maker of a model airplane wishes to try out his plane but has no rubber band on hand for the purpose. Get a few large rubber bands at a drug store and cut them as shown in the drawing. By this method you



can get a band 30 in. long, and any number of these can be tied together.—Asa Arent, Humboldt, Iowa.

Cement for Celluloid Rims

Celluloid rims of eyeglasses can be repaired by acetic acid or acetone, which is obtainable at any drug store. The acid is applied to the broken ends, and they are then held together tightly for several minutes until the cement has dried. The

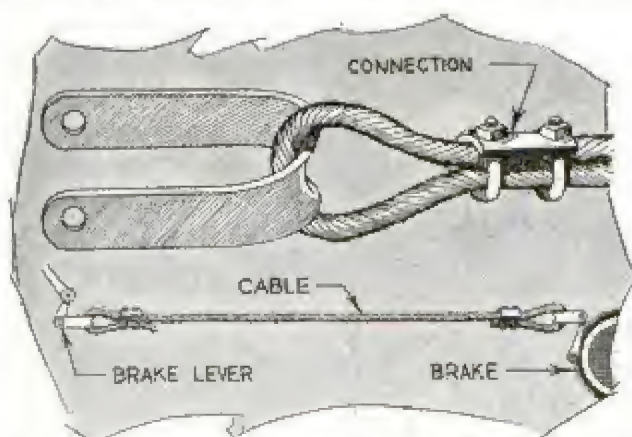
acid softens the celluloid, which makes it more or less sticky, and if the pieces of celluloid are pressed together while in this condition, the joint will be nearly as strong as an unbroken piece of the material. When repairing rims in this way care must be taken to set the lens at the correct position in the rim. However, this repair should be attempted only in case you are sure the glasses are used for correcting simple near or far-sightedness without astigmatism.—Jesse T. Simmons, Salt Lake City, Utah.

Winter Protection for Bush Fruits

Covering the tips of black raspberries with dirt to protect them during the winter can be done conveniently and quickly in the following way: Pin the bushes down against the ground with a pitchfork, placing the fork about halfway to the top of the bush. While they are held in this position, throw a few shovelfuls of dirt on the tips to hold them down. The bent bushes catch the winter's snow and this protects them against the weather.—C. Bernard Peterson, Buffalo, N. Y.

Cable Replaces Noisy Brake Rods

Rigid brake rods often rattle annoyingly and many of the older cars have an offset bend which tends to straighten out when



Substituting Steel Cable for Rigid Brake Rods Eliminates Rattle and Gives More Positive Brake Control

pulled, making it difficult to get a smooth and effective brake grip. These objections can be overcome by using stranded steel cable. Such a substitution can be made by any car owner. The method of clamping the cable to the brake connections is shown in the illustration.



Shelf for the Breakfast Nook

An auxiliary shelf will be found a great convenience in the breakfast nook for holding the sugar bowl, salt and pepper shakers and other table accessories, which must be removed from the table when the cloth is changed. Besides, the shelf provides additional space when the table is crowded. It consists merely of a 1-in. board of suitable length, finished nicely to match the woodwork, and supported on angle brackets as indicated.—Hi Sibley, Pasadena, Calif.

Lace Curtains Used for Stencils

Wide-mesh lace curtains can be used for stenciling wall panels. The curtain is first cut to the desired size and is tacked over a light wooden frame after which it is given one or more coats of thin shellac to stiffen it. Too much shellac should not be used if there are any small openings in the curtain design. The purpose of stiffening the fabric in this way is to prevent it from pulling out of shape when used. The stenciling is done in the usual manner by means of a stippling brush. It is advisable, in taking up this idea, to experiment a little in order to get the paint of the proper consistency. If it is desired to use one stencil for a number of panels of different size, mount it on two round sticks from which as much or as little can be unrolled as required to fill the space.—J. S. Hagans, Chicago.

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A Scale-Model Plane



View of the Ford Tri-Motor Scale-Model Plane. Mounted as Though in Flight; Note the Realistic Appearance of the Ship as Compared with the Full-Size Plane on the Opposite Page

By **WALTER BULLOCK**
Pilot, Northwest Airways, Inc.

THE BIG all-metal tri-motored Ford air liner, with its silvery corrugated duralumin covering, its three big Wasp engines and shining steel propellers, makes one of the best of all planes for the exhibition-model builder to copy, for a well-made scale model is not only beautiful, but represents hours of careful and interesting work.

This is the story of how to build an exact model on a scale of $\frac{1}{16}$ in. to 1 ft. This scale gives a wing-spread of $24\frac{5}{16}$ in. and a length over all, from the boss of the propeller hub to the tip of the tail, of $15\frac{1}{2}$ in. That's just a nice size to hang from the chandelier, place on the bookcase or mantel, or, possibly, sell or rent to a merchant who wants an unusual window display.

Because duralumin cannot be soldered, we will build our model of thin sheet brass, nickel-plated, on a fuselage and wing made of wood. The brass used is .008 in. thick,

and can be obtained already corrugated and nickelplated. To build the model, you will need, besides the usual saws, planes, hammer, and other common carpentry tools, a draw or spokeshave, to carve out the wing, soldering iron, small nose pliers, tinnerns' snips, and a supply of small round-head brads in $\frac{1}{4}$ and $\frac{3}{8}$ -in. lengths, to represent the rivets of the original ship. The brads can be obtained ready nicked to match the covering.



We will start with the wooden framework for the fuselage. It consists of a tail block, nose block, bottom board, two sides, a bulkhead between the passengers' and pilot's compartment, and a floor block for the pilot's cockpit. Tail, nose and floor blocks are of white pine, and sides, bottom and bulkhead of three-ply wood, $\frac{1}{8}$ in. thick. In lieu of plywood cigar-box wood can be used,

but the former is preferred, as less likely to split under bending strains.

is Easy to Build

The tail block, shown in Figs. 1 and 1A, comes first. It is cut from a block of white pine, $9\frac{11}{16}$ by $2\frac{1}{2}$ by $1\frac{1}{2}$ in. Lay out the side pattern first from Fig. 1, which is full size, except that it is "broken." The projecting part, curved on the underside, fits over the top of the wing. Care should be taken to follow the proportions of the curve exactly in constructing your pattern. The $\frac{1}{8}$ by 1-in. slot at the other end is to take the horizontal stabilizer. After you have cut the block to the side dimensions, lay out the top pattern, and, with a scrollsaw, complete the sides, taking care not to break the thin ends.

The nose block, Fig. 2, comes next. It is cut from a block of white pine, $1\frac{1}{4}$ in. square and $1\frac{3}{8}$ in. long. Measure in $\frac{3}{16}$ in. from one end around three sides of the block, and take a saw cut $\frac{1}{8}$ in. deep. On the corresponding faces of the end, measure in $\frac{1}{8}$ in. and saw down, cutting away the three pieces, forming the rabbets in which the sides and bottom will fit.

Find the center of the other end of the block and inscribe on it a $\frac{3}{4}$ -in. circle. If a lathe is available, the block can be turned down to this dimension, as shown in the sketch. Otherwise it may be cut down with the chisel and finished with a fine file and coarse sandpaper. The sides are slightly curved, and not straight as in a true cone. The



Above, a Northwest Airways Ford Ship in Flight; Inset, Mr. Bullock, the Author of the Article

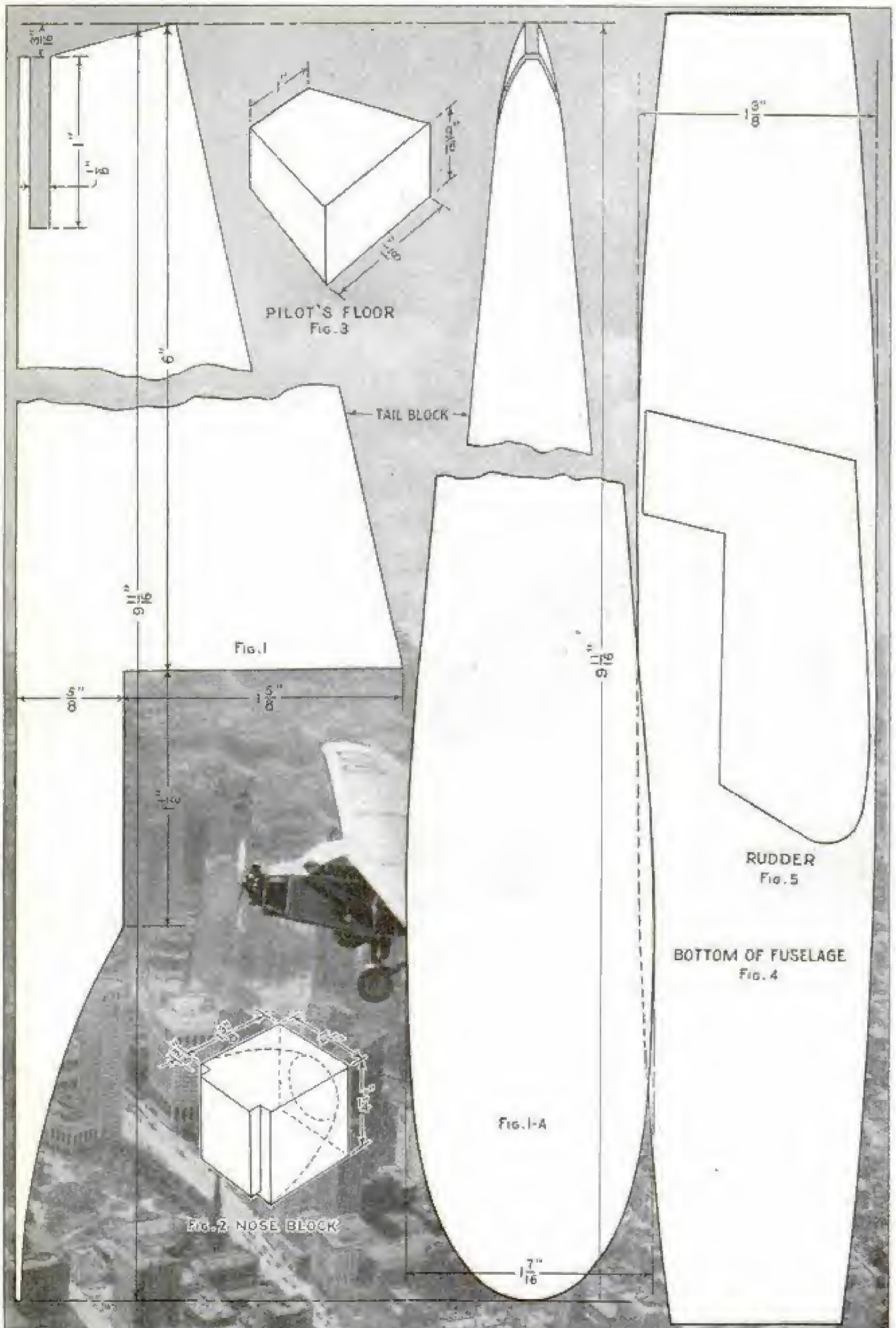
curve will carry out the lines of the fuselage when completed. The block tapers out, when finished, from the $\frac{3}{4}$ -in. nose to the $1\frac{1}{4}$ -in. rabbeted back. The drawing, Fig. 2, might seem to indicate that the block tapered up from the rabbeted end, but this is due to the perspective, and the block really tapers the other way. A reference to the photo on page 1031 will make this clear.

The floor block for the pilot's cockpit is cut from white pine $\frac{9}{16}$ in. thick. It is $1\frac{1}{8}$ in. wide at one end and 1 in. at the other, as in Fig. 3.

Next comes the bottom of the passenger compartment. A full-size template for this is given in Fig. 4, so no special instructions are needed. Either $\frac{1}{8}$ -in. plywood or other material of similar thickness is used, cut out and filed to size.

The sides of the fuselage are shown in the full-size template, Fig. 6. There are six windows in a row and a smaller

A complete set of parts can be obtained, at a moderate cost, for making this splendid model. Write to Amateur Mechanics Dept. for list and prices.



window above the forward one. The V-shaped notch in the top, with its upper side slightly curved, takes the rear, or trailing, edge of the wing, when the assembly is completed. Two sides are needed, so, after transferring the pattern to a piece of the $\frac{1}{8}$ -in. stock, fasten two pieces together with small brads and saw them at the same time. This saves time and insures the two sides being exactly alike. Drill holes in the spaces marked for the window openings, thread the blade of the coping saw or jig saw through the holes, tighten it in the frame, and saw out the openings. It is best to cut the outline of the pieces first, however, as, if one attempts to cut the window openings first in a large sheet of the plywood, it is found that the swinging of the saw is awkward in some places. Cut the pieces from the sheet to the approximate size necessary, trace the pattern on one, brad them together, and then saw out the outlines of the pieces, leaving the windows to the last.

Fig. 8 shows the bulkhead or partition between the passenger compartment and the pilot's cockpit. The illustration is full size, and can be transferred with carbon paper to a suitable scrap piece of the $\frac{1}{8}$ -in. material.

Fig. 7 gives the dimensions for the vertical fin. The long side is the base, which later will be attached to the tail of the fuselage. Cut the fin, like the rest of the

tail assembly, from $\frac{1}{8}$ -in. stock. The rudder is shown in Fig. 5, full size, and is transferred direct to the stock by using carbon paper.

Fig. 9 shows the horizontal stabilizer, with all dimensions, and Fig. 10 the elevators, of which two are needed. Both can be cut at once by tacking two strips of the $\frac{1}{8}$ -in. stock together, after laying the pattern out on one piece.

The ailerons are shown in Fig. 11. Be sure to cut these to exact size, as they must fit into recesses to be cut in the wing.

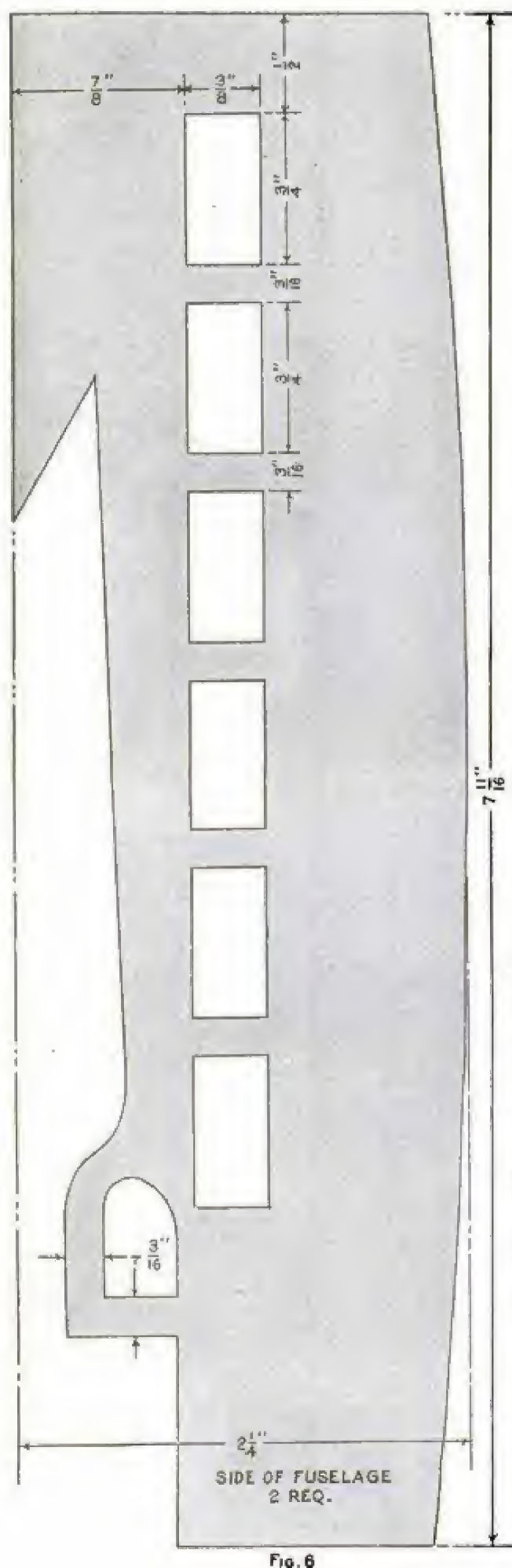
This completes the woodwork of the fuselage, and you are now ready to assemble the parts, round off the top and finish it. Set up the tail block and hold one of the sidepieces against it, matching the V-notch in

the top of the side with the overhang of the tail block, into which the wing is to fit. Mark the top and rear edges of the side on the tail block, and cut out a recess to a depth of $\frac{1}{8}$ in. Do the same with the other side, then cut a $\frac{1}{8}$ -in. rabbet in the bottom of the tail block to take the floor of the fuselage. One end of the bottom board measures $1\frac{1}{2}$ in.; this end is the rear. Glue it to the tail block, and reinforce the joint with some small brads.

Glue and nail the other end in the recess in the nose block. Be sure that the after side of the nose block and the forward end of the tail block are square with the center line of the bottom, to prevent the fuselage



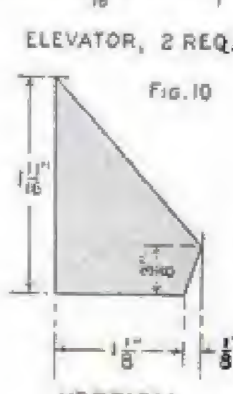
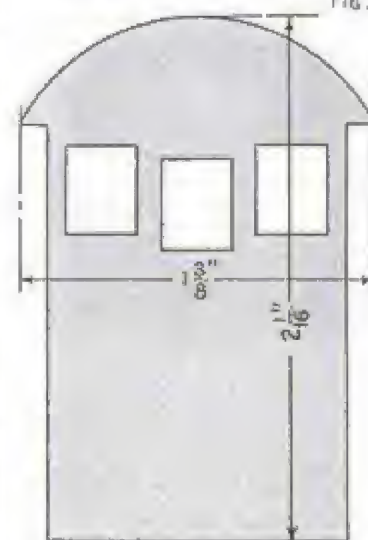
WALTER BULLOCK, an old-time pilot, as pilots' ages go, who got his start barnstorming in the days when planes wore their propellers behind and were pushed through the air instead of being pulled by tractor air screws, is, in his spare time between runs, a builder of fine scale models. His models of the big Wasp-engined tri-motored Ford air liner, which he flies between Chicago and St. Paul-Minneapolis, have been widely acclaimed for their fine workmanship and exact detail. In this and subsequent articles Mr. Bullock tells how to build a metal-covered scale model of the plane he flies.



from being "in wind" or twisted when the sides are put on.

You are now ready for the sidepieces. First glue and nail them to the tail block, taking care that the notch in the side exactly matches the curving overhang of the tail block. Next, gluing and nailing as you proceed, bend them to fit against the bottom board, and bend the latter until it matches the edge of the sides. A few small clamps will aid greatly in this operation. Bend the pieces gently to fit each other, following the bend up with small brads, carefully driven in to avoid splitting the thin wood. Take the same precaution when fitting the sides as with the bottom board, that is, see that they fit the recesses or rabbets in the nose and tail blocks properly, and that neither the nose nor the tail is "cocked" up or down in relation to the sides. There is little difficulty in assembling the pieces, but some precaution is essential, if the finished fuselage is to be perfect.

Countersink the nails with which you attach sides and bottom to the nose block,



and with chisel or knife and sandpaper smooth the sides and bottom to match the curve of the nose block.

Rounding off the top of the tail block is next in order. Draw a line from the rear point of the V-notch in the sidepieces to the lower edge of the stabilizer slot, on either side of the tail block, and round the block down, from the top center line to the side lines, giving it an easy, smooth curve.

Glue the floor block for the pilot's compartment to the floor, sides and nose block, and glue the bulkhead in place behind it. The bulkhead should be flush with the projecting portion of the sides, which contain the small upper window.

That completes the wooden portion of the fuselage. Next comes the cowlings around the pilot's cockpit. This is cut from a thin sheet of galvanized iron, $\frac{1}{2}$ by 5 in., to the template given in Fig. 12. Transfer the pattern to the galvanized iron, and with a cold chisel cut out the windows, smoothing the

edges of the cuts with a small file. Next, with tinners' snips, cut out the outline. Bend the two center flanges to a right angle. Then bend the strip in the center in a

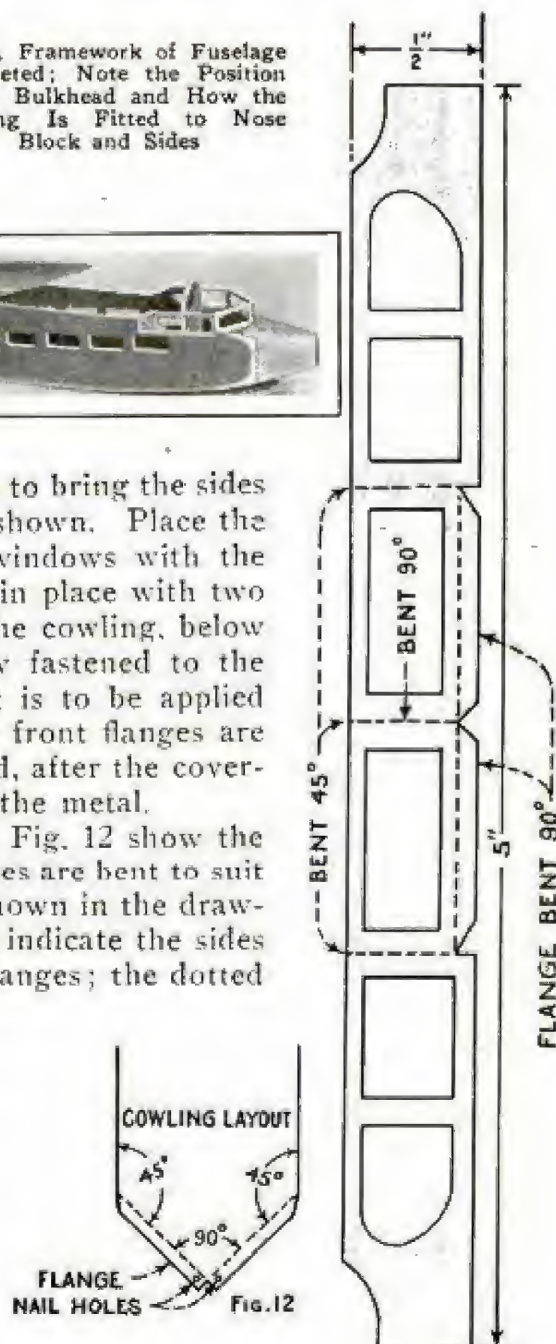
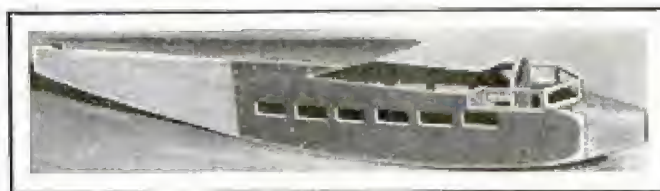
right angle, as shown, and make the two 45° bends to bring the sides back parallel. Drill the two small nail holes, as shown. Place the cowlings over the nose, matching its rear side windows with the small upper windows in the fuselage, and nail it in place with two small brads. The small flanges on the sides of the cowlings, below the windows, are not bent out, neither are they fastened to the fuselage at this stage. The metal covering that is to be applied later holds them down. The small brads on the front flanges are withdrawn when the metal covering is applied and, after the covering is replaced, driven into place again through the metal.

The dotted lines in the drawing at the right in Fig. 12 show the points where the bends are made. The small flanges are bent to suit the nosing of the plane, and the other bends as shown in the drawing at the left. The full lines in the latter sketch indicate the sides of the cowlings and the outer edges of the small flanges; the dotted lines, to which the degree arrows run, are the vertical portions of the cowlings, at the front.

You are now ready to make the wing, and next month's article will give instructions for this, and also tell you how to apply the metal covering to wing and fuselage, and fashion the roof of the pilot's compartment, while succeeding installments will be devoted to the making of the landing, propelling and control gear and the rigging of tail surfaces and ailerons.

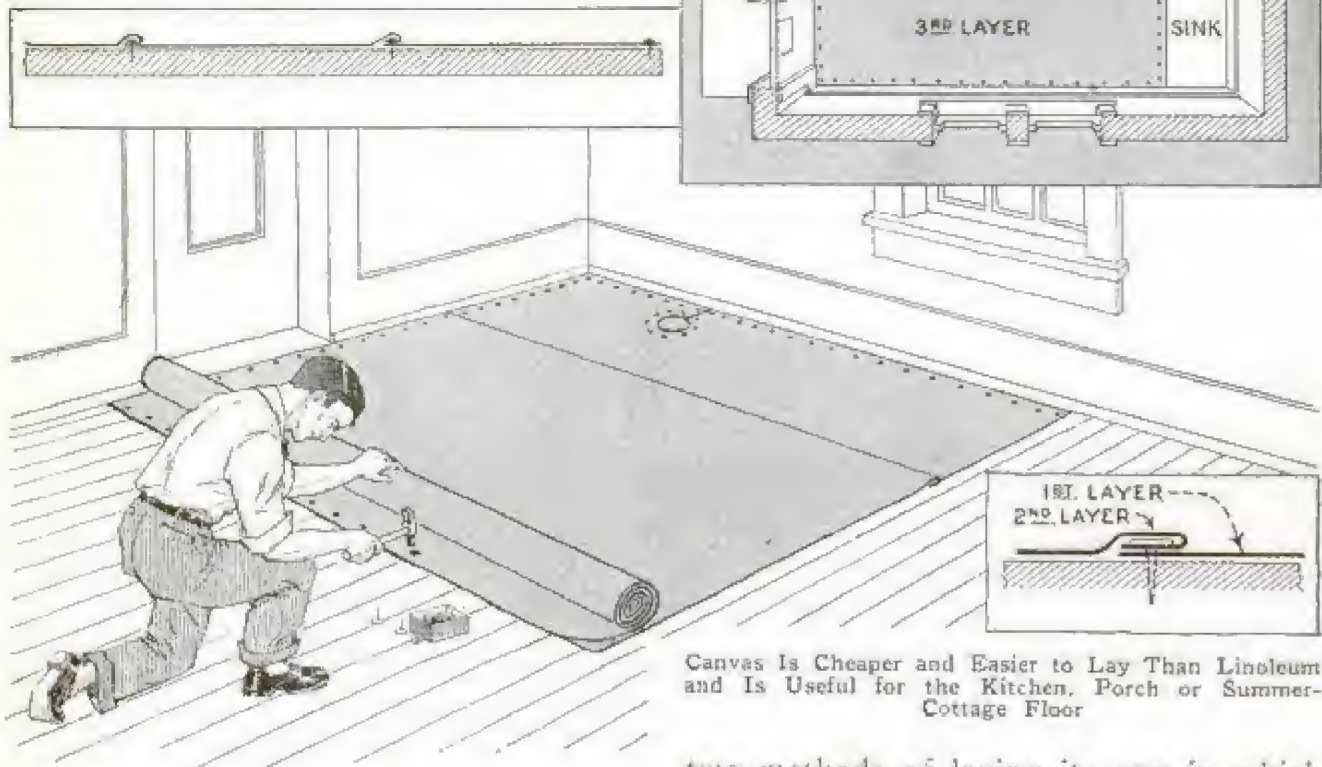


Below. Framework of Fuselage Completed; Note the Position of the Bulkhead and How the Cowling Is Fitted to Nose Block and Sides



Canvas Floor Covering for the Kitchen Is Cheaper than Linoleum

Canvas floor covering for the kitchen, porch or summer cottage has been found entirely satisfactory for those who do not desire to purchase linoleum, and the cost of the canvas is less. It is also very easy



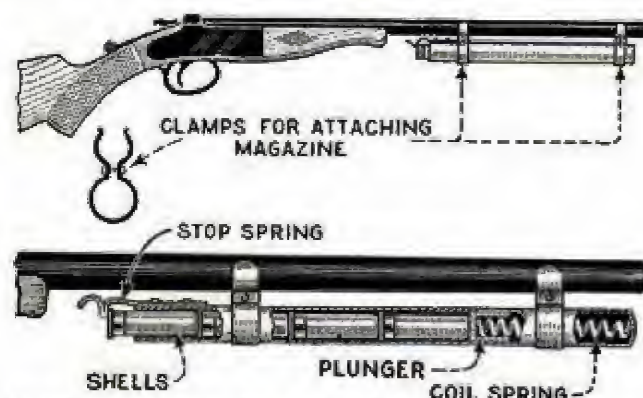
Canvas Is Cheaper and Easier to Lay Than Linoleum and Is Useful for the Kitchen, Porch or Summer-Cottage Floor

to lay, as it is pliable, permitting it to be rolled and folded to get around stoves, boilers and cupboards. The finished job is waterproofed by painting and varnishing it, and this practically cements the canvas to the floor. Get 12-oz. duck of 30-in. width for the purpose. There are

two methods of laying it; one in which the tacks at the joints show, and the other where they are completely hidden. The latter method is preferable as the tack heads will eventually rust if exposed, due to the paint wearing off. The details of laying the canvas are shown in the illustration.—John Steinke, Cleveland, Ohio.

Auxiliary Magazine for Shotgun

Owners of single-barrel shotguns will find the auxiliary barrel, shown in the illustration, quite a convenience, as it permits quick action. It consists of a bicycle-pump cylinder, a coil spring, just fitting inside of it, and three spring-brass clamps, one for the open end of the pump cylinder and the other two



Handy Cartridge Magazine Made from Old Bicycle Pump for Single-Barrel Shotgun

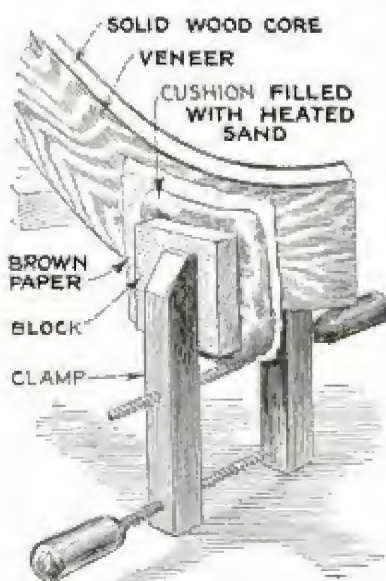
clamping the cylinder to the gun barrel as indicated. A wooden plunger fitting loosely inside of the cylinder is also provided. In use, the loaded shells are pushed against the plunger and into the magazine. After a few shells are pushed in the stop spring is brought down, preventing the shells from being ejected. To remove a shell, the stop spring is pushed up.—C. M. Wilcox, Torrington, Conn.

Postage Stamps Prevent Headlight Glare

Sticking postage stamps on the left side of your glasses to protect the eyes against glare from approaching autos is a good measure for a motorist to adopt. In the absence of stamps, use the gummed part of an envelope or a piece of adhesive or friction tape.—W. G. Webb, Hudson Falls, N. Y.

Regluing Veneer on Curved Surfaces

A problem often met with by the home mechanic is that of refastening veneer which has been loosened as a result of water-soaking or drying of the glue. This occurs frequently on chair joints and seats, on curved dresser fronts and a variety of places where rare veneers are used. In factories, cauls or specially shaped forms are used, but these would take considerable time to make at home. The following method has been used with success: First loosen the veneer with a knife and scrape away the dust and old glue between the veneer and the solid wood or core. Then apply glue to both surfaces. Have ready some fine, clean sand that has been heated in a pan. Fold a quantity of the sand inside of a piece of heavy cloth or canvas to form a cushion. Put the cushion over the loose veneer



with a piece of brown paper between them. Lay a block of wood over the cushion and clamp together, as indicated in the drawing. Under the pressure of the clamp the veneer will be held against the wood at all points. Allow the glue

to dry for 24 hours and then remove the cushion. Usually the paper sticks to the wood, but this can be removed with a moistened cloth.—E. L. Bilodeau, Corry, Pennsylvania.



Arranging Flowers in Shallow Dish

Cut flowers with short stems are rather difficult to arrange in a shallow dish. Partly submerged, they float around in the water and it is almost impossible to keep them set in an attractive way. By using moist sand instead of water the flowers will look just as fresh as they do in water, and any desired effect in color scheme and general makeup can be obtained with assurance that it will last as long as the flowers live.

Spreading Liquid Glue Quickly

Difficulty is sometimes experienced in spreading liquid glue evenly and quickly over a large surface. This can readily be done, however, by using a spreader made by notching the edge of a piece of linoleum or stiff cardboard, about 6 or 8 in. long. The notches are cut at intervals of $\frac{1}{2}$ in. on the long side of the linoleum, producing a sort of comb. It is advisable to make the tool about 5 in. wide, so that the fingers will not come in contact with the glue. Then pour glue on the surface to be covered and you will find how evenly and quickly it can be spread.—Douglas Leechman, Ottawa, Can.



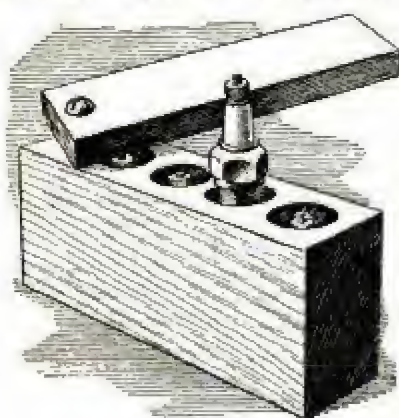
Small Wooden Airplane Supported on Strong Overhead Cable Brings Large Profits to Its Child Owners

There's Money in Aviation

This novel trolley airplane brings its young owners five cents per ride and all the children in the neighborhood are just eager to take the air in it. The plane is made of wood and is supported by a stout overhead wire cable securely fastened at both ends. The propeller is made of wood pivoted on a pin so that it will turn, but the real propelling force is a boy who is glad to push the plane for a small portion of the profits. One day the profits amounted to \$3.15.

Handy Spark-Plug Container

Spark plugs will be safe from being broken if carried in a simple wooden container made from a piece of 2 by 4-in. stock. Four or more holes are drilled in the piece, as shown, to accommodate the



spark plugs, and a wooden cover, made of 1/2-in. stock, pivoted to one end with a wood screw, holds the spark plugs in the case. It may be mounted on

the motor side of the dash or carried in the tool box.—A. C. Wilson, Columbia Cross Roads, Pa.

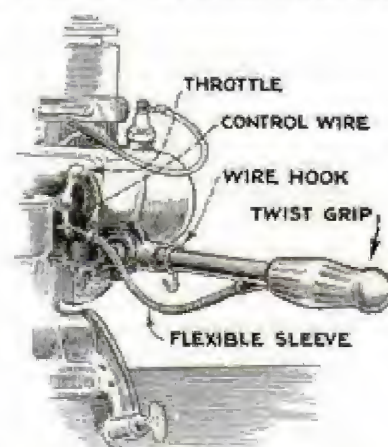
Imitation Brick for the Christmas Fireplace

For the Christmas fireplace and other decorations involving the use of imitation brickwork, realistic effects are obtained by making "bricks" from 2 by 4-in. wood and painting them red. The mortar joints are closely imitated by using strips of plaster-board, sawed a trifle narrower than the bricks. Materials such as ma-

sonite and celotex can be used to furnish shades of brown and buff mortar. "Headers," that is, bricks laid end to the surface of the wall, are made half the size of regular bricks or "stretchers." If it is desired to make the finished job more or less substantial, long nails can be driven through the bricks to hold them together.

Automatic Shut-Off for Outboard Motor

In racing outboard motor boats many use a motorcycle twist grip on the throttle control. It frequently happens that the racer tips over and finds that one or



both of his cylinders are cracked owing to water getting in through the breather pipe. This can be prevented by using a rubber band cut from an old inner tube. The band is attached to the handle by means of an improvised wire hook, and is slipped over the control lever of the throttle so that the moment one releases the twist grip, the throttle will close.—H. E. Whiting, Rochester, Minn.

Improving the Crosscut Guide

Large work often has to be cut with a small saw, and an extension of the crosscut guide as shown in the drawing will facilitate the performance. Its principal object is to support the outer end of long work when making a square cut, or tenoning and grooving with the dado head. In this instance, the guide was made to the dimensions given for a 15 by 17-in. table. The wood used was seasoned hard maple, $\frac{7}{8}$ in. thick. Quartered oak of the same thickness may be used as a second choice. Rip a piece of either material 2 in. wide and of the required or desirable length. Plane the edges carefully, making sure that they are perfectly square and true lengthwise. The beveled piece C is 30 in. long and 5 in. wide. Cut out a portion of it so that the iron guide will fit as indicated. Drill $\frac{1}{8}$ -in. holes through the face of the iron guide and fasten it with wood screws to a piece of stock set on edge against the piece C. Be sure to bring the guide exactly to the square position. Part A consists of two pieces, each 5 in. long, glued together and fastened to the guide with screws and glue, being rabbeted as shown to ride on the underside of the saw table. Only sufficient clearance should be allowed for the guide to move easily. If the table edge is rough, smooth it with a file. The pieces B are fastened with screws and glue. The curved piece is sawed to the shape shown, about 10 in. long, and serves to support the guide in case the saw is run in or the dado goes some way beyond the edge of the work. Screws are also used to fasten it. Although it is necessary to cut into the guide with both the dado and the saw, the guide will not be impaired if the operator is careful to let the cut run no farther than necessary.—W. Clyde Lamme, Downers Grove, Ill.



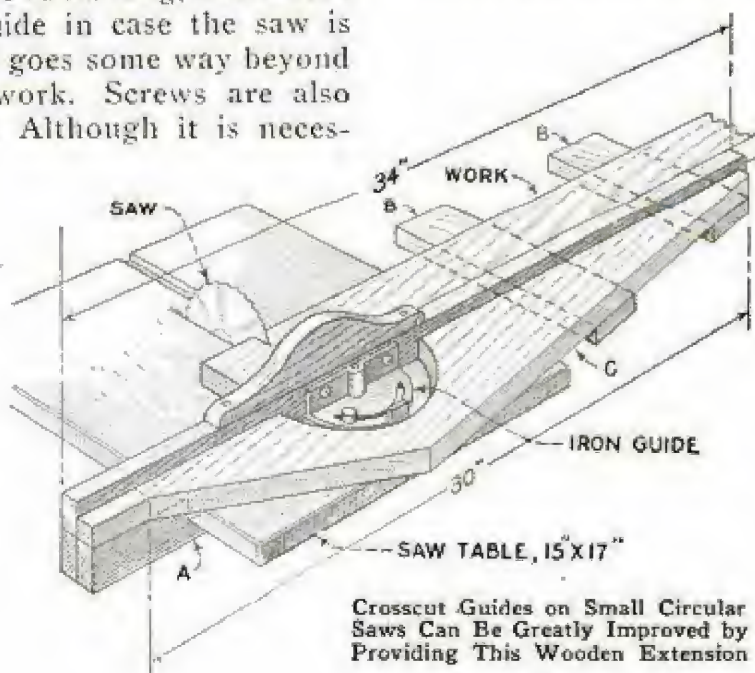
Extra Shelves behind the Basement Stairway Provide Good Place for Preserves

Extra Shelves in the Basement Provide Storage for Preserves

Extra shelves that are out of the way can be readily built behind the basement stairs. The shelves stretch the full width of the stairway and cleats are nailed on each side, as shown in the photo, to support them. Paint cans, preserves, etc., can be kept on these shelves without any risk of being knocked off.—Morton Schwam, Philadelphia.

Black Ink for Writing on Glass Does Not Spread

Writing on glass with black ink is usually not successful, as nearly everyone has found, but it can be done with a solution made of silicate of soda, 2 parts, and india ink, 20 parts. Use an ordinary writing pen of good quality. This ink will not flow out on the glass surface after being applied, but will remain just as written.—L. H. Georger, Buffalo, N. Y.



Crosscut Guides on Small Circular Saws Can Be Greatly Improved by Providing This Wooden Extension

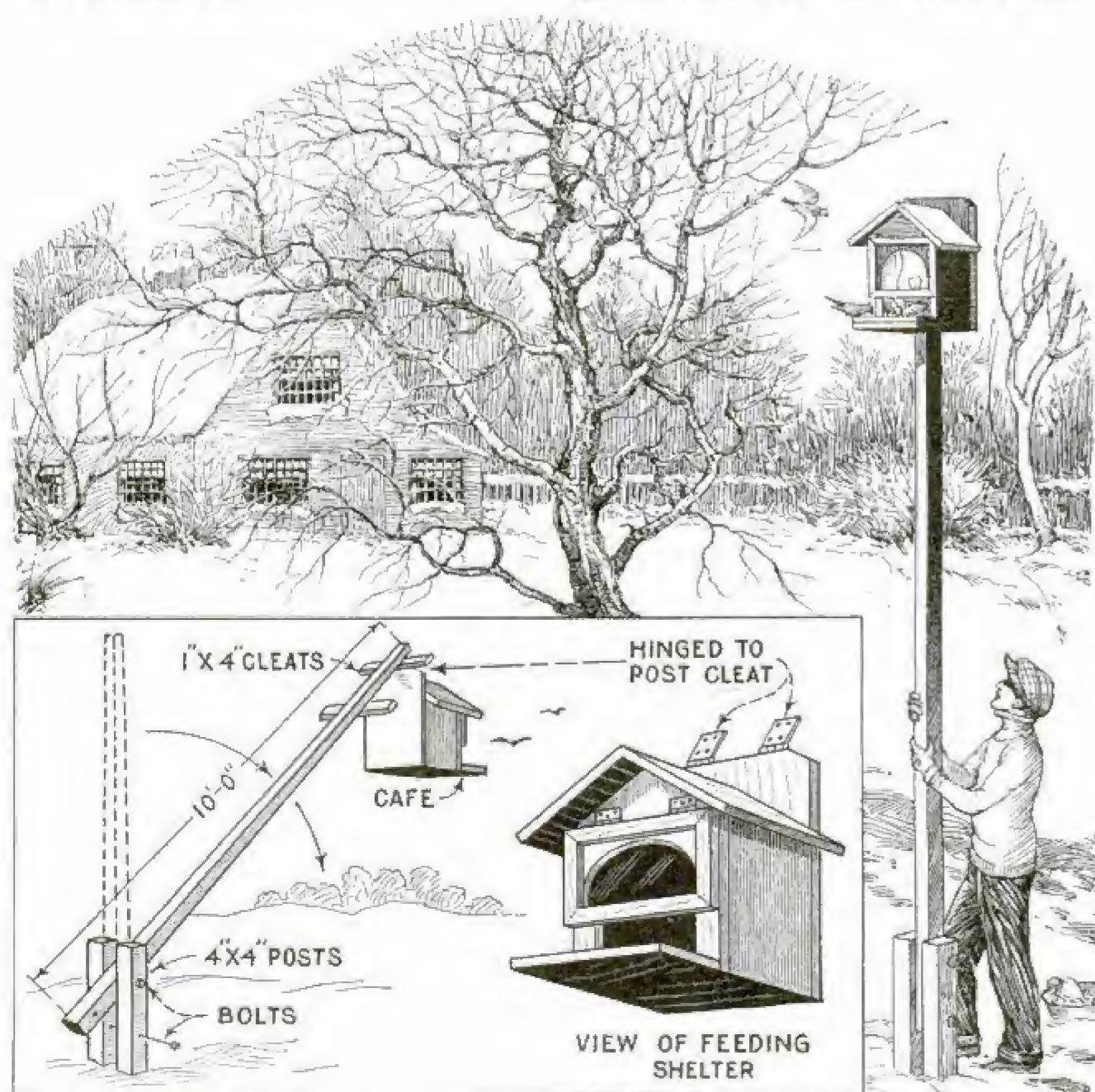
A Heated Cafe for Birds

By D. R. VAN HORN

THE FIRST time your winter birds poke their heads into this heated winter shelter, with warmth radiating from a lantern inside, they will no doubt wonder what it's all about. But it won't take them long to decide that this is a pretty decent place to swap gossip and warm their toes, to say nothing of the food. By setting up this cafe, all the birds in the neighborhood will make it their rendezvous this winter.

An ordinary storm-proof lantern, which you no doubt have on hand or can get for a small sum, furnishes the heat inside. The large door faces the south and this is partly covered with a frame to which a sheet of celluloid or glass has been fastened. This keeps out most cold breezes or storm—yet lets the sunlight through.

Set at the top of a pole mounted between two posts, the cafe can be lowered quickly at any time for refueling or put-



This Heated, Easily Tended Feeding Station Will Keep the Birds Happy All Winter

ting out more feed. The box is hinged at the top and hangs vertical when lowered.

While the dimensions may be varied to suit, a good size is 12 in. wide, 10 in. deep and 18 in. high. You can also alter the design, but the one shown represents a snug, attractive and weatherproof affair, easily made from $\frac{1}{2}$ -in. lumber, straight from the mill or from old boxes.

Make the front side nearly all open, consistent with good appearance. Let the backboard extend above the peak of the roof 2 in., as a pair of hinges go here. The floor also should extend 2 or 3 in., and if you feed oats or other light grain, you may find that a low railing, about 1 in. high, will be helpful in preventing grain from blowing out.

Next, build a frame for the front from $\frac{1}{2}$ -in. material, 1 or $1\frac{1}{2}$ in. wide. Miter the corners and use four-penny finish nails to hold the pieces together. Cut a shoulder around the inside back edge for glass if glass is to be used. If a celluloid or celloglass sheet is being used, simply tack this down. A ribbon of rubber cement about its edge will make the joint tight. Now hinge the frame at the top to the front side of the cafe.

Use a pole from 10 to 12 ft. high between the two posts, for the support. Nail two cleats, spaced 12 in. apart, at the top and then hinge the top of the backboard to the top edge of the upper cleat. The lower cleat simply makes a broader spot for the lower part of the cafe to rest against. In a hard wind this will swing out slightly, but not enough to cause damage.

All that now remains to do is to fill the lantern and set it inside by raising the front glass frame. The frame of the lantern will keep the flame far enough away so that there will be no danger of fire. During cold weather, especially when the ground is covered with snow, the cafe should be lowered daily and more feed put in. The lantern can also be filled once every one or two days, the wick being turned down until there is only half the normal flame.

One of the best winter feeds for birds is, of course, suet. Put out, with this, bread crumbs and various kinds of grains. You can tell, with a little experimenting, which kinds of grain are in greatest demand.



Hookless Fastener Applied to Child's Bedding Insures Keeping Covers On

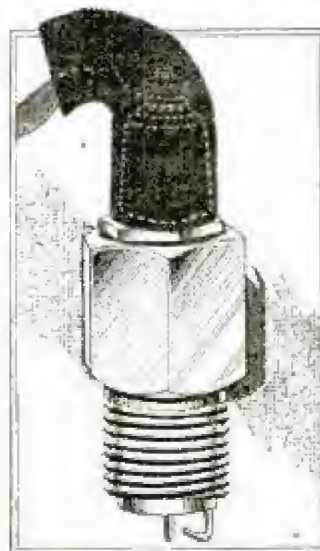
Cover for the Child's Bed

As a means of preventing a child from kicking aside its bed clothing on a cold night, the arrangement shown in the drawing will be found serviceable. The cover is pinned to the side of the crib and is made to open and close in the center by means of a hookless fastener. Such fasteners can be salvaged from discarded garments or bought at department stores.

Rubber Tube Keeps Spark Plugs Dry

When moisture gets under the hood of an automobile, as is often the case when the car is washed or when it stands out in a driving rain, the spark plugs will not function. This is due to the high-tension

current short-circuiting over the wet porcelain section of the plug between the top and the body. To prevent such trouble, slip a 3-in. length of rubber tubing over the cable end and porcelain section of the spark plug, as shown in the drawing.—F. W. Wilhelm, Cincinnati, Ohio.



Washer Makes a Good Hermaphrodite Attachment for Dividers

For use with the ordinary dividers, a satisfactory hermaphrodite attachment



can be improvised by the use of a washer. Take a washer $\frac{1}{4}$ or $\frac{3}{8}$ in. in diameter, and bend it double, laying a small nail between the sides as they close at right angles to the bend, and then hammering them

down over the nail. This makes a small sleeve or pocket for the divider point. The washer can be conveniently held against the work while scribing.

Potting House Plants

A common mistake with potted plants is that of overfilling the pot. A properly potted plant should not have the earth heaped up around its stem and left level with the rim of the pot, but should have the ground level an inch or so lower than the rim in moderate-sized pots and more than that in large ones. There should be room for the water of a moderate irrigation to stand for a few moments, while it soaks down into the soil, without washing any of the dirt over the edge.

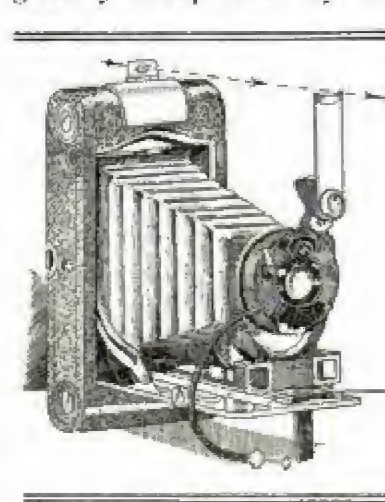
Another sin we are apt to commit against the plant is one of omission: We are prone to want to fill the pot with good, rich soil, without providing for ventilation or bottom drainage. The hole in the bottom of the pot should be covered loosely with a broken bit of another flowerpot or some such potsherd. Then a layer of loose pebbles or cinders should be shaken on the bottom, and on top of this the soil in which the plant is to be set. The soil of ordinary back-yard gardens is too heavy and close for potted plants. It should be mixed with sand, and especially should it have leaf mold, or

humus from the woods, added to it. This will give it a much lighter, porous character, decreasing its tendency to puddle after watering. It will also enable the pot to drain more quickly, giving better soil aeration; roots need air as well as water.

Our usual tendency is to overwater plants, and then let them stand with their roots in the mud, threatening them with "smotheration." Water may be supplied in the usual way, by pouring it on top, or by setting the pot in a deep pan of water and letting it soak up from the bottom. In either case, however, the pot should be set aside to drain for a while. The common practice of setting a potted plant in a jardiniere half full of water and leaving it there should by all means be discouraged. The plant should be lifted out of the jardiniere for watering, then returned and set on a couple of blocks of wood, and be left standing there so it will drain. Water should never be allowed to accumulate in the jardiniere. When the leaves of ferns, for example, begin to turn brown, the common assumption is that the plant requires water, whereas, as a matter of fact, it may be getting too much water from standing in a half-filled jardiniere.

Photographing Moving Objects

Taking photos of moving objects is greatly simplified by the camera sights



shown in the drawing. They are made of sheet metal and two small hinges having one screw hole. It is necessary to arrange the sights so that, when the user sees the object through them, it will be in the range of the

camera. When not in use, the rear-sight hinge is folded down flat and the front sight is turned in front of the lens. The release string can be coiled up in the usual way.—George Thompson, Thermopolis, Wyo.

*U. S. Lycopodium Co,
300 W. Adams
Chicago*



Decorating with a Pastry Gun

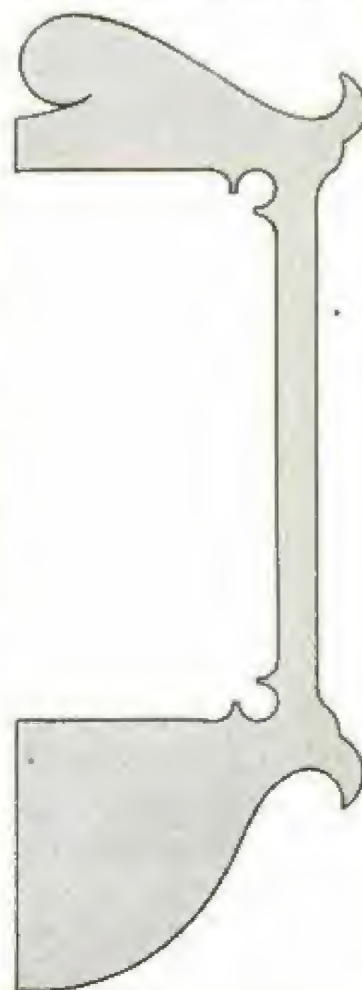
Albert Bick Co., 1200 W. 35th St., New York 2, N.Y.
By J. S. HAGANS.

FOR the decoration of plaques, panels and other decorative objects, textone or similar plastic paint, applied with a pastry gun, or, as it is sometimes called, an icing gun, offers endless possibilities. By the simple process described almost any degree of relief can be obtained, and almost any form of ornament applied. The only equipment required is the pastry gun, and the only material a quantity of the plastic-paint powder.

Almost any kind of base will serve for the application of the decoration, although, for the plaques, etc., that the process is specially suitable for, wall-

board forms the lightest and most desirable base. Given the object to be decorated, the first step is the preparation of a suitable background. In the examples shown, this is done by the application of a coat of the plastic to the surface with a brush. While still wet, the surface is manipulated with the tips of the fingers, sweeping them in a circular motion over

Using the Pastry Gun to Form the Outline of a Ship for Plaque; Right, Design for Picture Frame or Display Stand



the plastic, and forming an irregular background of pleasing form, but with no suggestion of pattern. Allow the work to dry, which will take overnight, and then sandpaper down the rough ridges of the plastic.

Assuming that the design for an ornamental border has been selected, the next thing to do is to trace this onto the surface of the piece. The pages of magazines offer an endless variety of designs suitable for the process of decoration. If the design selected for the border or panel is small, it is recommended that it be enlarged to the proper dimensions by means of a cheap pantograph, which can be obtained at any art store, unless, of course, one has some ability as a free-hand draftsman, when the design can be sketched directly onto the background. When laying out borders for frames, panels, etc., it is sometimes difficult, even for the experienced draftsman, to get both sides of the design alike. This difficulty is overcome by drawing one half of the design, full size, on a sheet of paper, as in the sketch, page 1039, and then tracing this half onto the background. The paper is then turned over, matched with the first tracing, and the other half traced. The design, of course, is drawn heavily enough so that no difficulty is encountered in following it on the back of the paper.

With the outline drawn on the background, it is only necessary to fill the gun with the plastic paint and follow the outlines, in exactly the same manner as the pastry cook decorates her cakes, leaving a stream of the plastic to form the design. This is allowed to harden.

The whole is now coated with white shellac to kill the porosity of the ma-

terial. In the examples shown in the illustrations, the raised outlines of the pictures have been coated with glossy black enamel, and this is done after the shellac is dry. With the outlines coated, the remainder of the background is then colored. This can be done either in solid color, or by an adaptation of the polychrome method.

In the latter method, the part to be decorated is coated with paint and allowed to dry. Then a coat of some contrasting or harmonizing color is applied, and, while still wet, a part of this is wiped off. This removes the second color on the high spots, allowing the first coat to show, while the second color remains in the lower parts of the background. Sometimes three or more colors are used. An examination of a commercial article will show the process of polychroming in a few minutes.

No directions as to color can be given, as obviously this depends entirely on the article being decorated, but it may be said, in general, that for small objects, bright colors may be used, while for larger ones the colors must be more subdued if the effect is not to be glaring.

The articles illustrated at left on the opposite page, while not entirely decorated by the pastry-gun method, show what can be done in the way of furniture decoration with plastic paint and wallboard, either for the home or for window-display purposes. With the exception of the "pottery," all the articles are built up from wallboard. These few examples will suggest numerous others to the alert reader. For example, the antique lantern, in imitation of beaten copper or iron may be made either



Bird-of-Paradise Design for a Wall Panel, an Article of Furniture That Will Brighten Any Living Room

from thin wood or wallboard. Skill in joining the parts is unnecessary, as the joints are all covered afterward by the plastic. The hammer marks are formed in the "metal" by daubing the moist sur-



Right, Another Decorative Wall Panel; Left, All the Articles Shown in This Photo, Including the "Pottery" and the Chest, Are Finished with Plastic Paint, in the Simplest Manner

polychroming, it will generally be found advisable to apply the metallic-bronze coat first, allow

face with the finger tips. If the effect of iron is desired, the surface is painted dark gray and allowed to dry. Then apply a coat of aluminum paint and wipe off the high spots. When dry, kill the high gloss of the aluminum with a thin glaze coat of burnt umber. For antique copper, use a green-paint base and a copper-bronze overcoat in the same manner.

The frame at the left of the lantern is made of wallboard also, the relief decorations being applied with the gun. A narrow brush can be used for these, if desired. This frame is finished in gold, with a second coat of green, wiped off as before. The pottery on the table is just cheap glassware of the "five-and-ten" variety. They are simply coated with plastic and given various polychrome finishes. In

this to dry, and then apply the paint coats that are to be wiped off. Some bronze paints absorb color from the second coat, and this is particularly true of aluminum bronze, so, wherever this is used, apply a coat of white shellac over it before putting on the color coat.

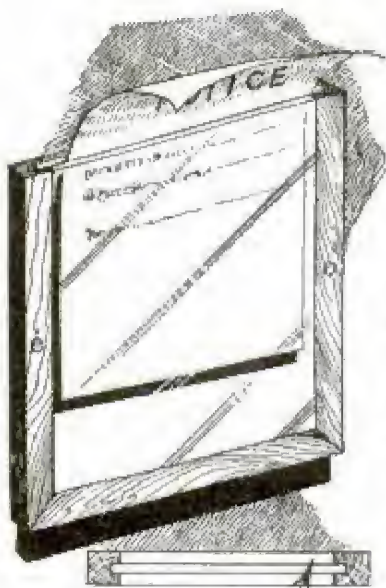
The antique chest is built up of plywood, or, if it is to be used solely for display purposes, and if it will bear no great weight, it may be made of wallboard over a wooden frame. The panel effect on the top is quite simply obtained by tacking down a rectangle of wallboard over the top proper, no matter what the construction of the box. The ornamental border is cut with a coping saw from a thin strip of plywood and tacked in place. The whole box is then given a coat of plastic, tex-

dry or powdered. paint or drug store

just like aluminum bronze

tured with circular movements of the finger tips, the border design being modeled with the tip of one finger. The edge of the lid is textured by making a series of vertical grooves with the finger. When hard, the surface is lightly sanded to soften the effect, and finished as desired. The one in the photo is treated with black paint and silver-bronze to produce the popular antique-silver effect.

Handy Shop Bulletin Board



SLOT FOR SIGNS

Where framed signs and notices have to be changed frequently, the frame, unless it has been especially made for the purpose, must be taken down to insert a new sign after the old one has been removed. This inconvenience can be overcome by using the bulletin board shown in the illustration. It consists of a three-sided wooden frame with a groove on the inside to receive a glass pane. Insertion or removal of notices is made through the open top.—Herman R. Wallin, Brooklyn.

Correct Method of Repairing Car Chassis

Loose frame members in autos are a source of rapid depreciation, cause considerable noise and involve an element of danger. Cracks frequently start from holes in which rivets have loosened owing to vibration and strain. Looseness and cracks can best be detected by rubbing chalk on the outside of the member around the head and then squirting penetrating oil against the other side. Another test, but one which requires more skill, is tapping the rivet with a hammer. Avoid welding whenever possible, because of the spoilage of near-by paint and possible injury to heat-treated metal parts. Shear off the head of the loose rivet with a

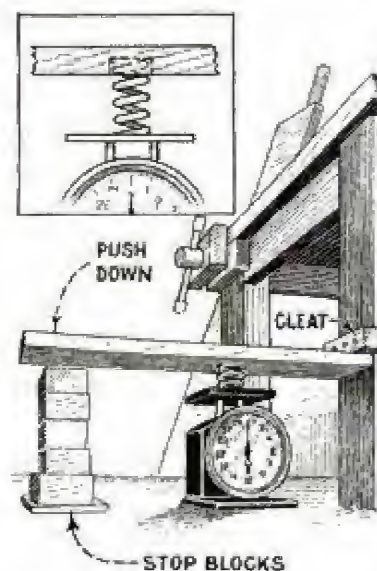
chisel and hammer or drill it out. If a crack has started from the rivet hole, trace it to its end and drill a $\frac{1}{8}$ -in. hole through the frame at that point, to check further cracking. As rivet holes will usually be found to be elongated, enlarge the hole by reaming to about .004 in. under the diameter of the next larger cap-screw. If the threaded portion of the latter is a trifle less than the combined thickness of the frame members, it will be necessary to chase the threads down nearer to the head with a die. The collar of the screw should be a tight drive fit in the hole. Use an extra-thick new lock washer, and tighten the nut as much as possible without stripping the threads. The writer has used this repair for many years and his experience is that it will prove permanent.—Paul Leo, Elizabeth, New Jersey.

Holding Small Objects in a Vise

When small objects, such as brass terminal heads, have to be tapped, there is considerable difficulty in holding them in a vise. I have found it better practice to grip the tap in the vise and hold the object between a pair of dies of the sliding type. It is then an easy matter to tap the work.—L. Moran, Dublin, Ireland.

Device for Testing Valve Springs

The drawing shows a simple method of testing the strength of valve springs, making use of a scale, a length of 2 by 4-in. stock, a number of stop blocks and a cleat.



The cleat is nailed to the bench leg, a hole is bored part way through the 2 by 4-in. material to receive the end of the spring, which is set on end on the scales, and the stop blocks are arranged as indicated. By pushing on

the improvised lever thus arranged, the strength of the various springs can readily be determined and the weakest ones replaced. The stop blocks insure that exactly the same amount of pressure is applied to each spring.

Test Shows Filter Reduces Oil Changes

If automobiles are equipped with oil filters, frequent changes of the oil in the crankcase are unnecessary, a test trip across the continent tends to show. On the trip, during which the speedometer showed 10,025 miles of travel, it was found that, after a change of oil, the viscosity dropped rapidly for about 200 miles, and then changed little for 500 miles. The tests on acidity showed much the same results, the acidity rapidly rising for about 200 or 300 miles, and then showing small variation. In addition to the oil filter, the car was fitted with a crankcase ventilator, and both carburetor intake and breather were protected against dust.

New Type of Filing Cabinet Takes Little Space

Light and compact, this novel filing cabinet, made in the form of a sloping box,



has handy features which make it highly useful for certain purposes. It is $37\frac{1}{2}$ in. high at the back and 22 in. high at the front, and measures 16 by 24 in. in length and width. The opening of the box is 31 in. long and is divided into 22 compartments. The divisions consist of pieces of wallboard slipped into $\frac{7}{16}$ -in. slots cut in the sides. The material used for building the cabinet is white pine. A hinged lid, made by placing a wallboard panel in a suitable frame, is provided.

☐ A piece of cord is useful as an emergency gauge in resetting a camera tripod, or in preventing it from shifting.



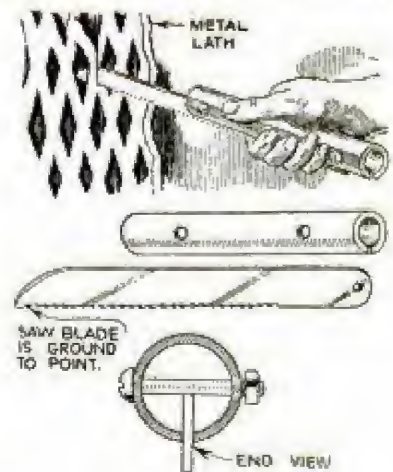
Reflecting Light into Dark Corners Saves the Workman's Time

Work Lighted by Reflector

Polish the surface of an ordinary celluloid visor or place a mirror on your cap so that it will reflect downward on the work, as shown in the drawing. In this way any dark corner, or bottom of a hole where a screw must be driven, can be lighted sufficiently to save considerable time.—Geo. K. Sangster, Namu, B. C., Canada.

Using a Hacksaw in Confined Places

When it is necessary to use a hacksaw in confined places, try the method indicated in the illustration. The blade is ground down to a point and is held in a handle made of pipe. The pipe is cut through lengthwise on one side and two screws are used to tighten the handle on the blade. This tool has been found especially useful by electricians in cutting through metal lath, armored cable, scraping insulation and many other operations. It can be assembled in a few minutes and will serve as a valuable supplement to any tool kit.



Angle-Iron Corner Fixture for Clamps

Difficulty is often experienced in fastening mitered corners together while the work has to be held square. Fig. 1 shows

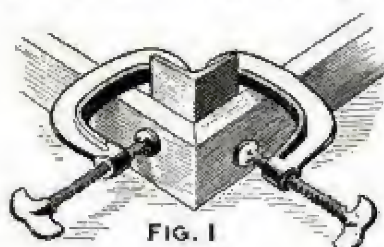


FIG. 1

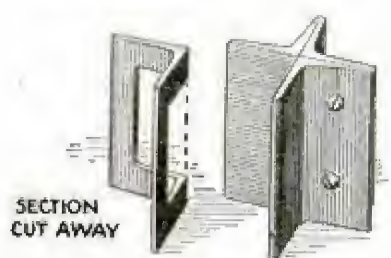


FIG. 2

how a piece of 2-in. angle iron of appropriate length and a pair of clamps can be used to advantage. Fig. 2 illustrates a fixture that is of considerable value in working with sheet metal, for holding the pieces together while welding, brazing or other operations. Three pieces of angle iron are fastened together, while a fourth piece, of which the center section is cut away, is also provided. In use, the work is placed inside of the main part of the fixture, and the slotted section is pushed in against the work to hold it firmly in position, after which clamps are applied. The fixture can be laid on a bench horizontally so that melted solder or spelter will run into the corner of the work instead of collecting along the sides.

Repairing a Short-Circuited Armature Section

To locate a short-circuited armature section, pass a current from a dry cell or storage battery through the armature, using the brushes of the machine. Using a low-reading voltmeter—a millivoltmeter if possible—touch its lead wires to one pair after another of adjacent commutator bars. A zero deflection of the voltmeter indicates a short-circuited section. It will be noticed, at periodic intervals in passing around the commutator, that the voltmeter deflection reverses, and that just before this transition point the deflection is less than normal. This merely indicates a passage from one pole to another on the winding. On a four-pole armature, for instance, there will be four such reversals of the meter deflection. Switching

of lead wires is all that is necessary to make the meter read in the right direction. If a short circuit is found, clean out the spaces between commutator bars, to be certain no small bits of metal or copper dust are responsible. Failing thus to locate the trouble, carefully lift out the coil connected to the bars to which the short was traced, and repair any breaks in the insulation. Shellac and silk ribbon are the best materials for this work. Apply the ribbon smoothly, coating it thoroughly. A broken circuit in the winding itself may be located by connecting a battery through the ammeter to two metal strips, held apart by a piece of wood at such a distance that they will touch adjacent commutator bars. Holding this device against the commutator, turn the armature slowly by hand. A reduced deflection of the ammeter indicates a broken or open-circuited winding. The only resort, in this case, is to lift out the damaged coil, solder the ends together, re-insulate and replace the wire in the slots.

Automatic Milk Cooler

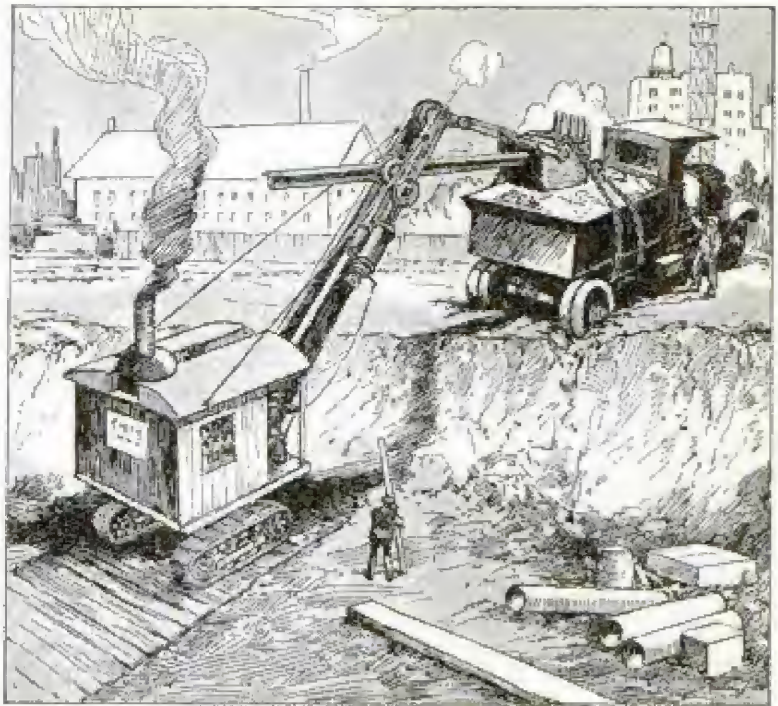
Cooling milk automatically with the illustrated device saves the farmer considerable time and keeps the milk more sanitary. It consists of a wooden tub in which a milk can is placed, and a paddle arranged inside of the can. The paddle is actuated by means of a pivoted crossarm, to the ends of which small cups are attached. The cups fill and empty alternately with water, the weight of which causes them to drop, and they are then automatically turned over so that the water runs out and causes the emptied cup to rise while the other one goes down and is emptied in the same way. The arrangement for filling the



cups alternately is simple. A container, which is funnel-shaped at both ends, is pivoted on a vertical rod, which supports the entire moving apparatus. Two brass or copper tubes, soldered to the end of each opening of the upper container, lead down to the two cups, the bails of which are swiveled on the ends of the cross-arm. A small hinge is soldered to the lower edge of each cup and to the side of a metal trough large enough to receive the water from the cup. When the cup is filled, it swings over and pours the water into the trough. Each trough is drilled to permit the water to run down into the wooden tub. This hastens the cooling of the milk. The paddle moves from side to side as the cups go up and down on the ends of the crossarm. A water hose is clamped to the upper container so that the water runs into one cup while the other one is being emptied.—Bert T. Williams, Clintonville, Wisconsin.

How to Hold a Fender Bow

When removing dents or bends from a damaged auto fender, it is often rather hard to keep it from flaring outward while hammering the metal back to shape. A Cleveland workshop made the illustrated device to prevent this. It consists of lengths of $\frac{1}{4}$ by $1\frac{1}{4}$ -in. flat iron. Two long pieces have loops at one end to allow a third length to slide in them so that the bar can be adjusted to any desired length. Thumbnuts or setscrews are provided to hold the pieces together after the proper adjustment is made. Short lengths of flat iron and thumbnuts, arranged in a similar manner, are used to clamp the bar to the fender as illustrated.—A. E. Granville, La Grange, Ill.



Arrangement of Steam Shovel Enabling It to Lift Truck Sunken into Soft Dirt near Excavation

Steam Shovel Lifts Heavy Truck

After sinking into soft dirt near the edge of an excavation, where a steam shovel was loading dirt into it, a five-ton truck was unable to pull out on its own power. No tractor was available to tow it and it seemed that the work would be held up for some time. However, the resourceful engineer of the steam shovel solved the difficulty in a few minutes by giving the truck a lift. A heavy chain was slipped around the truck and the top portion hooked over the shovel.

Prolonging the Life of Hammer Handles

The life of a hammer handle may be prolonged if the wedges and head are removed and the end soaked in linseed oil. The end should be placed in the oil and allowed to remain for three or four days. It should then be removed, wiped off and allowed to dry for a week before the head and wedges are replaced. The resulting toughness will be surprising.



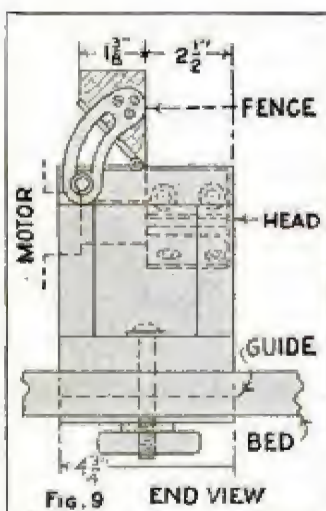
Adjustable Bar Holds Auto Fenders in Shape While Dents Are Hammered Out

Edward Thatcher
Pearsville, Ulster County
New York

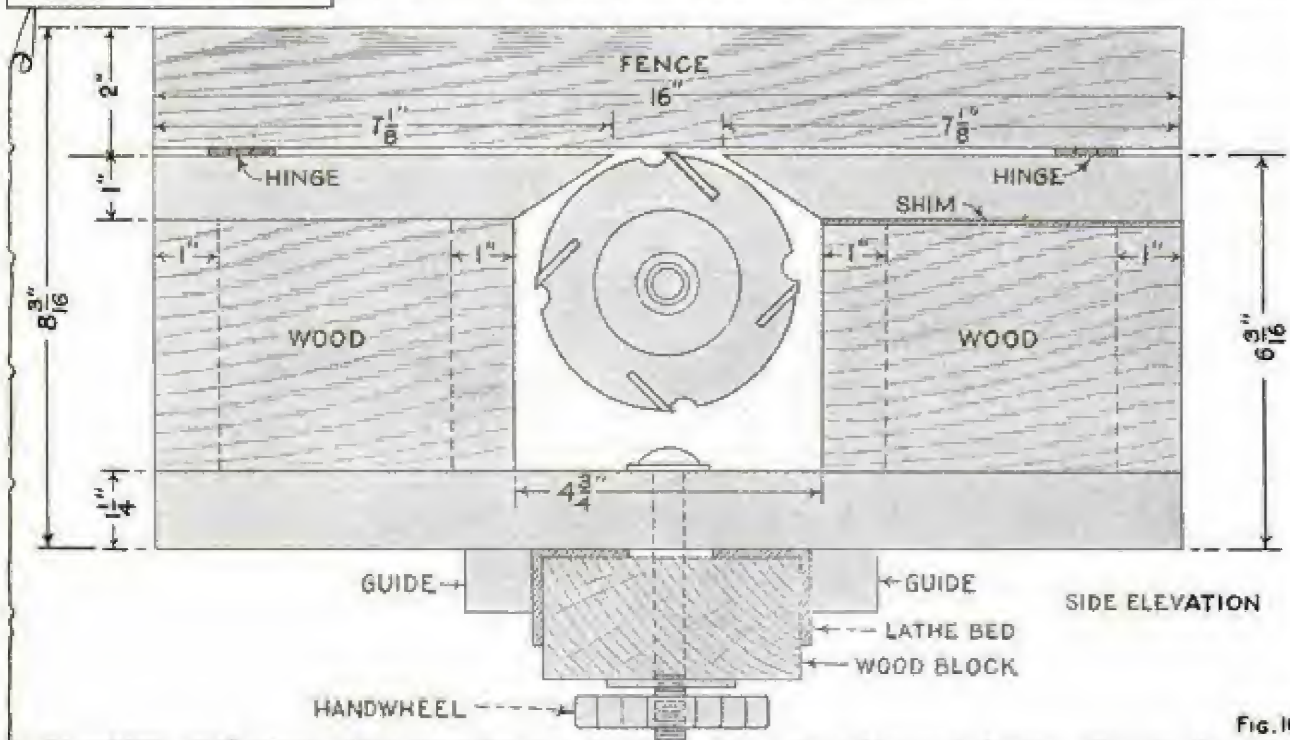
A Practical Home Made



By EDWARD THATCHER *Pearsville*
Ulster Co. New York PART II



THE JOINTER attachment for the combination workshop is shown in Figs. 9, 10 and 11. As may be seen from the drawings, the base of the jointer is a $1\frac{1}{4}$ by $4\frac{3}{4}$ by 16-in. piece, and above this are screwed two "boxes" made of 1-in. stuff, $5\frac{5}{8}$ in. long, $4\frac{3}{4}$ in. wide and $3\frac{1}{16}$ in. high. The exact height that the boxes are made will depend, of course, on the height of the spindle of the lathe and the size of jointer head to be used. The lower parts of the jointer bed may be of soft wood, if hardwood is not available, but the jointer tables, which are fastened on top of the boxes, should be of hardwood

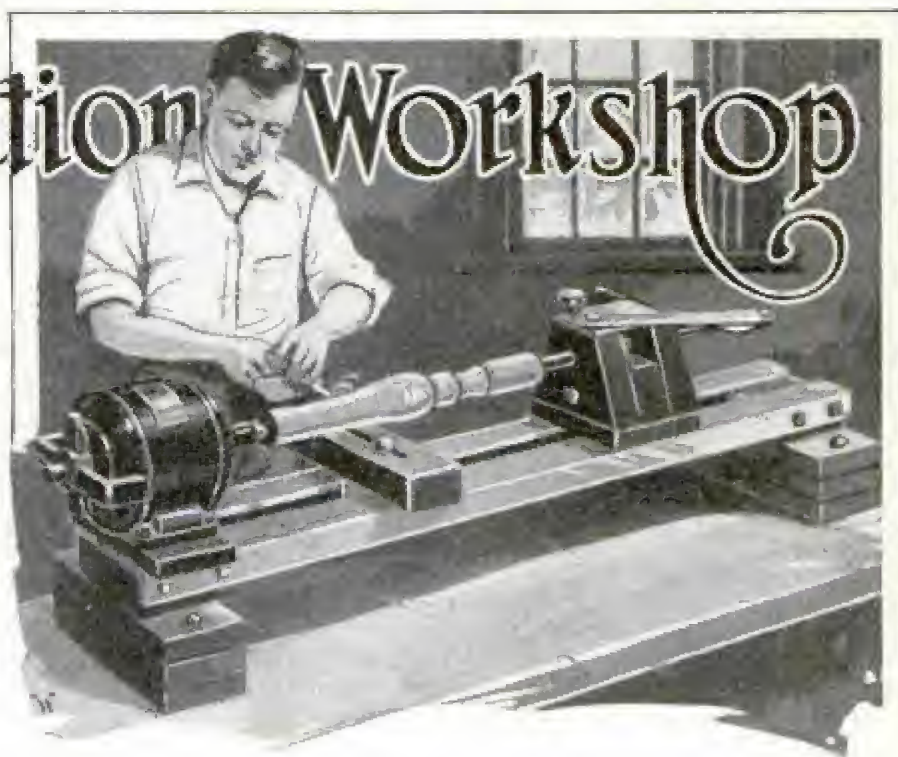


Combination Workshop

having a smooth, even grain. The tables are 1 in. thick, beveled back to accommodate the head used, as shown in the drawing, Fig. 10. The bed is fastened to the ways of the lathe by means of a bolt and handwheel, in the same manner as the other attachments, and guide strips, glued and screwed to the underside of the base, locate it positively with reference to the spindle of the lathe as shown in Fig. 10.

The tilting fence or guide is of hardwood, 16 in. long and $1\frac{3}{8}$ in. thick, to suit the 2-in. jointer head used on the original. The fence is beveled on the lower back edge so that stock can be planed at any angle up to 45° , and is hinged to the tables in the manner shown in Figs. 9 and 10. The curved guides that support the fence and enable it to be locked in any position may be made of sheet brass or steel, $\frac{1}{8}$ in. thick, either sawed out with a coping saw or cut with a chisel.

When the attachment is clamped to the lathe bed, over the head, as shown by the dotted lines in Fig. 9, the outfeed or table farthest from the operator is raised about $\frac{1}{2}$ in. by means of a shim of heavy cardboard of the same dimensions as the table. This gives the jointer a cut of $\frac{1}{2}$ in., sufficient for ordinary purposes. For heavier cuts, use a heavier shim. The adjustment of the cut should be made with the head



in place. A steel straightedge is placed flat on the rear table (the outfeed table) and projecting across the edges of the knives in the head. Each knife is adjusted in turn until it just touches the straight-edge when the head is turned by hand. Of course, the knife-edges should be square with the table tops, and firmly locked in the head before the motor is started.

The head used, Fig. 12, is one supplied by a commercial house, and costs about \$7. It dresses stock up to 2 in. wide and does the work very cleanly and smoothly.

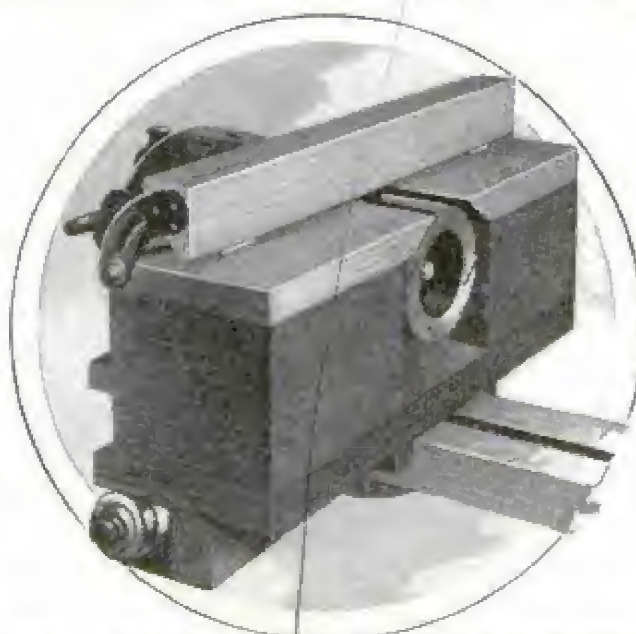
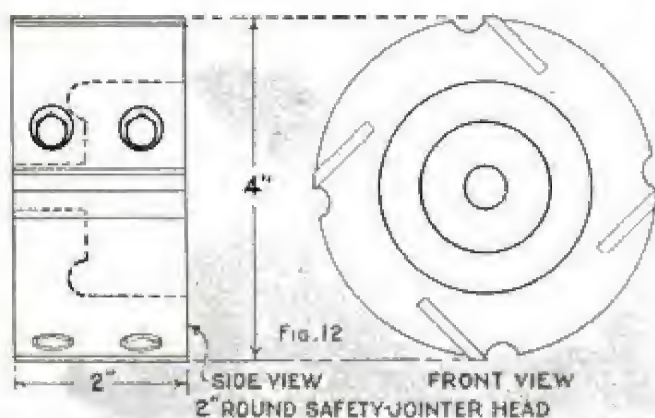


Fig. 11, a View of the Completed Jointer Attachment, Mounted on the Lathe Bed over the Headstock

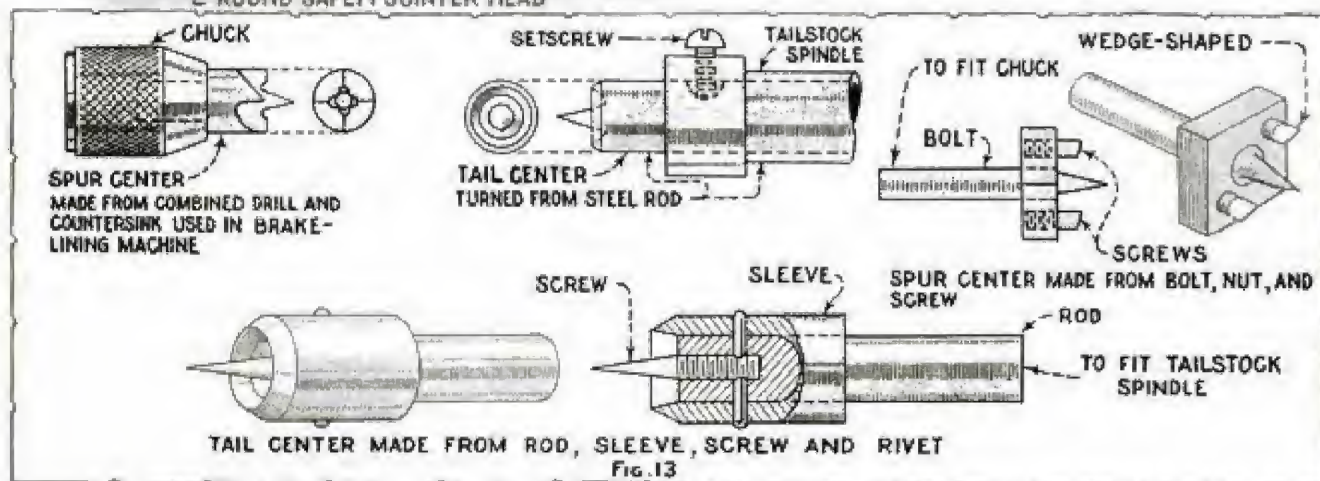
As to accessories for the lathe proper, the most used ones are illustrated in Fig. 13. The spur center may be made from a combined countersink and drill used in brake-lining machines in a number of garages. A dull one can be had for nothing, or a new one for 25 cents. Soften it by heating to a dull red and allowing it to cool under fine ashes, then file or

Paul J. Levitt
1047

Paul J. Levitt
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101 S 2nd



Another way is to use a section of mild-steel rod that fits the tailstock spindle. The end of this piece is drilled and tapped for a No. 8-32 screw. Screw tightly in place, saw off the head, and file to a tapering point. A sleeve is now made of mild steel to fit over the center, the outer end being turned down to a sharp beveled edge. The sleeve is held in place with a rivet passing through it and through the other parts as shown.



grind it to shape as shown. Place the shank in the lathe chuck and carefully file the short drill point down to a tapering point. The four chisel-like spurs of the center are easily filed up from the four countersink edges already on the tool. If you can, you may retemper the center, but it stands up very well in the soft state.

Another simple spur center is made up from a bolt and some screws. Saw the head off a $\frac{1}{4}$ -in. bolt, so that, when a nut is screwed down on the threaded end, the bolt will rest against the face of the drill chuck. Chuck it in the lathe and file the end of the bolt down to a sharp point. Drill and tap for two No. 6-32 screws in the opposite corners of the nut, insert the screws tight, cut off the heads and file the projecting length to chisel-edged spurs.

A tail center may be turned for the tailstock if you understand turning metal with hand tools in a speed lathe. Use a piece of $\frac{1}{2}$ -in. mild-steel rod, mounted in a hole turned for it in a block of hardwood, which, in turn, is mounted on the faceplate of the lathe. Form the center as shown in Fig. 13, and drill a spot on the shank for the setscrew of the tailstock spindle.

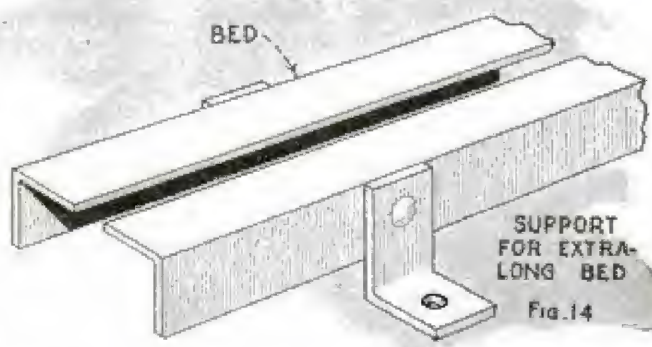


Fig. 14 shows the form of the supports used if the lathe bed is made longer than the original specifications.

The lathe and its attachments were painted with black and aluminum paint, as indicated in the various photographs accompanying this article, the wooden parts being given two coats of black enamel. The aluminum paint makes a very attractive and durable finish for the angle-iron bed of the lathe and other iron parts, as well as for the top of the tables on the sander and jointer. The inside of the angle-iron bed was painted a bright red in true small-lathe style.

It must be understood that the various dimensions given for the attachments describe those used on the original, and that any changes in the center height of the

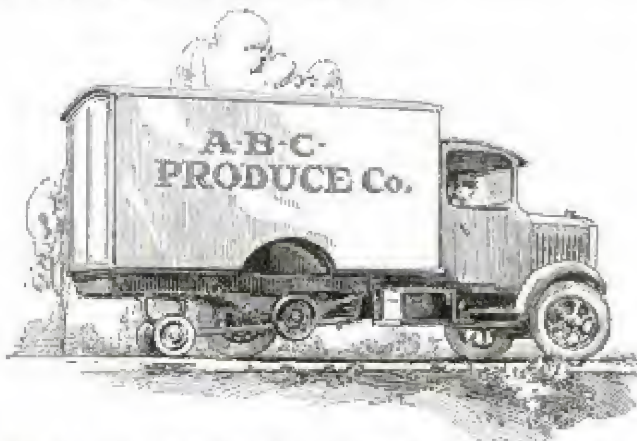
lathe, etc., will necessitate corresponding changes in the dimensions of the various attachments.

Overheating of Motor Caused by Water Pump

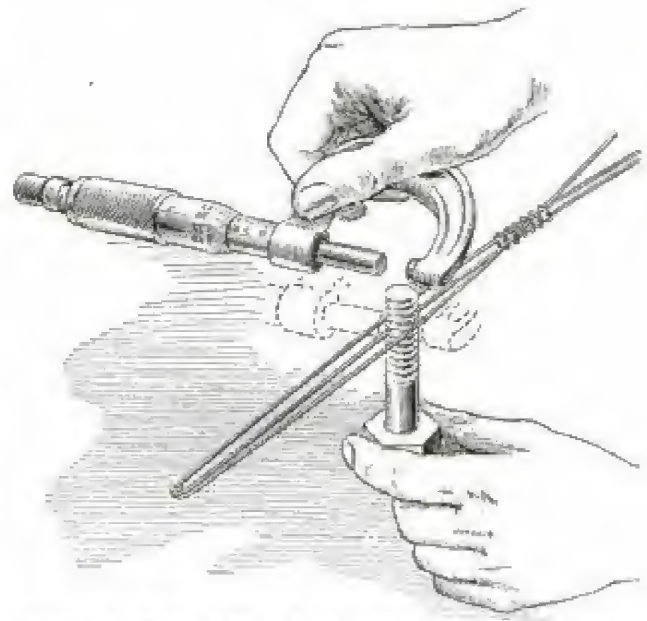
It cost me more than \$100 to gain the experience related here, although \$2 would have paid for the remedy at the beginning of the trouble. On a long drive my auto began to overheat and it became so serious that the radiator had to be filled several times daily. In an effort to have the fault corrected, I stopped at a garage and had the carbon removed, the valves ground, the ignition checked, a large fan installed and finally an entire new radiator put on, but the trouble persisted. Going over the entire motor carefully, it was discovered that the gland on the pump had been tightened too much after the packing had worn thin, in order to stop leakage, so that it pressed against the impeller of the pump, and, instead of helping to cool the water, the pump was actually heating it. By this time the pump was ruined, so that I had to replace it. Thereafter the cooling system functioned perfectly.—William H. Leach, Cleveland, Ohio.

Running Truck with Broken Rear Axle

After one of the axles had broken off inside of the rear wheel, I placed the ambulance under the frame to support the rear end and removed the wheel. By locking the jackshaft, often referred to as the drive axle, I was able to move the truck to a repair shop with the opposite wheel for a distance of seven miles.—Oli-ver Hahn, Allentown, Pa.



Truck with a Broken Axle Can Be Driven to Repair Shop on Its Own Power



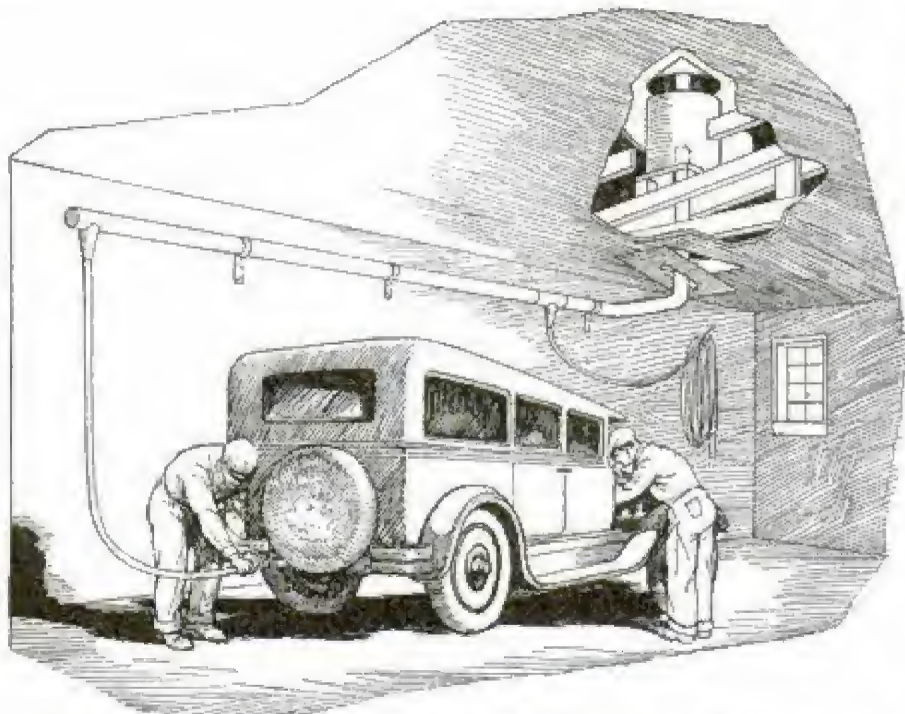
Small Coil Spring Slipped over Wires Makes It Easier to Check Threads

Device for Checking Threads

The three-wire method of checking gauges, bolts, etc., for pitch is in general use, but it is hard to hold the three wires, the bolt and the micrometer at the same time. The difficulty can readily be overcome by slipping a small coil spring over the ends of the wires as shown in the drawing. This holds the wires on the thread securely. Grasp the bolt with the left hand and the micrometer between the ball of the right-hand thumb and the palm so that the thumb and forefinger are free to adjust it.—Fred C. Wegener, Indianapolis, Ind.

Painting Imitation-Brick Joints

When painting a large warehouse, sided up with tin that was pressed to resemble brick, I found it a lengthy job to cover the imitation mortar with a small brush. To do the work quicker, I glued a layer of felt from an old hat around a paper-hangers' roller and found it quite satisfactory for my purpose. A small quantity of the lining color was put on a flat board and the roller pushed through a few times until the felt became well saturated with paint. After that, the roller is simply run in the depression and the paint is pressed on, causing the imitation lining to stand out in bold relief. Quite a large surface can be covered with one "rollerful" of color, and the work is neat in appearance.—C. A. Soots, North Salem, Ind.



Installation of Piping Connected with a Roof Ventilator to Exhaust Deadly Carbon-Monoxide Gas from Garage

Removing Monoxide Gas from Garage

It is generally known that carbon-monoxide gas is deadly when produced in a closed garage but every year there are car owners who succumb to the fumes after having forgotten to provide sufficient ventilation. Even in large garages where ventilation is provided, running motors often produce so much of the gas that, though it may not be noticeable, it, nevertheless, has harmful effects on the workers who constantly breathe it. To avoid the presence of this gas in his garage, one owner provided the arrangement shown in the illustration whereby the gas is immediately removed from the exhaust pipe of the auto and is conveyed through a pipe to a roof ventilator, which forces it outside. This arrangement can be followed by anyone who is interested in bettering the working conditions of the garage. The pipe connected to the roof ventilator is run along the wall and has tees at in-

tervals where hose can be connected to reach the exhaust pipes of the cars. In the case illustrated, the roof ventilator was provided with an exhaust fan, which forced the gas up through the pipe. The use of such a fan is essential as the monoxide gas is heavier than air and will not rise through the pipe of its own accord.—E. Moutoux, Riverhead, N. Y.

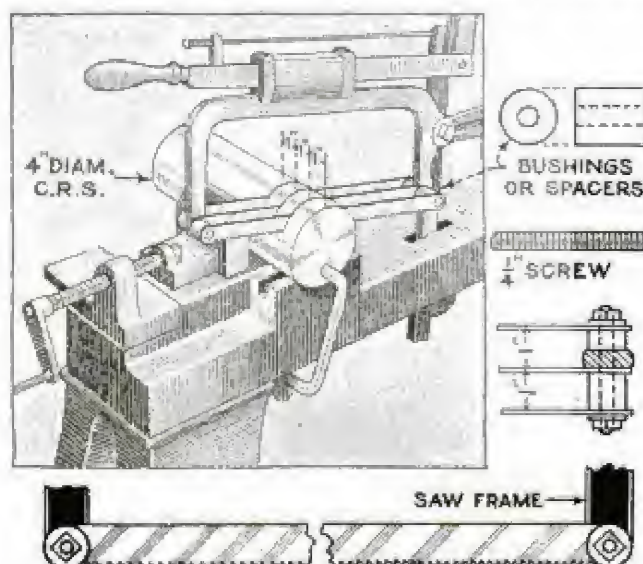
Machines Oiled at Close of the Day Start Easily in Cold

When running machinery in cold weather even hot oil, put on before starting, sometimes cools in the oil passages and does not flow to the bearing surfaces until undue friction warms them enough to soften it. To overcome this difficulty, oil the machinery immediately after shutting down at night. The bearings being slightly warm, the oil gets to the bearing surfaces, and is ready for the start next morning, when more oil can be put on if required to prevent overheating.

Power Saw Cuts Disks Quickly

To saw off disks from rods, or washers from tubing, on a power hacksaw, the il-

lustrated method was found highly satisfactory. Instead of using only one blade, three blades are fitted to the saw frame, with spacers between them so that three equal pieces are cut off at once. The work can then be accomplished in one-third of the time required when a single blade is used.—Geo. Linquist, Philadelphia.



Tripling the Speed of Cutting Off Disks and Washers on a Power Hacksaw

Making a Hammered-Copper Pipe Holder

By DICK HUTCHINSON

A RATHER novel and very useful pipe holder is the one illustrated below. It is very simple to make, will prevent the spilling of ashes over the desk or table, incidentally saving the pipe smoker from a lot of scoldings, and, if fastened permanently where it is most used, will eliminate many searches for that pipe that was just laid down "some place." The only material necessary is a piece of 23-gauge soft copper, 9 in. long and $3\frac{1}{4}$ in. wide.

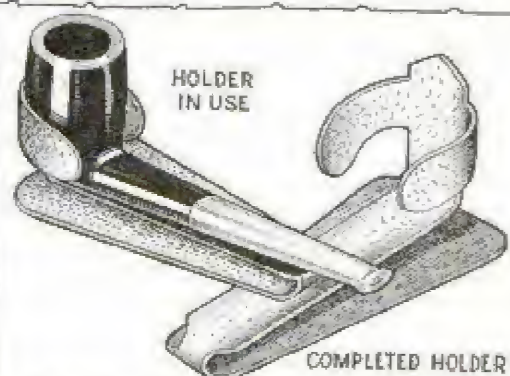
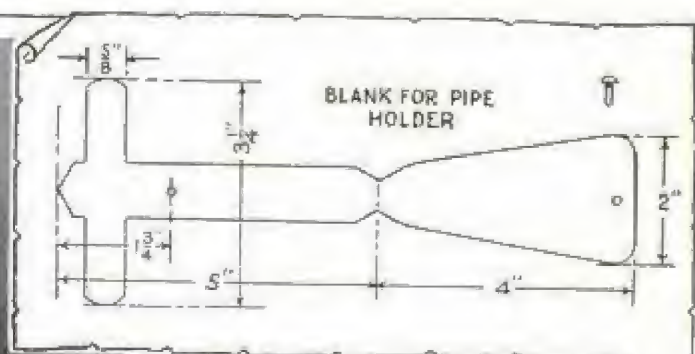
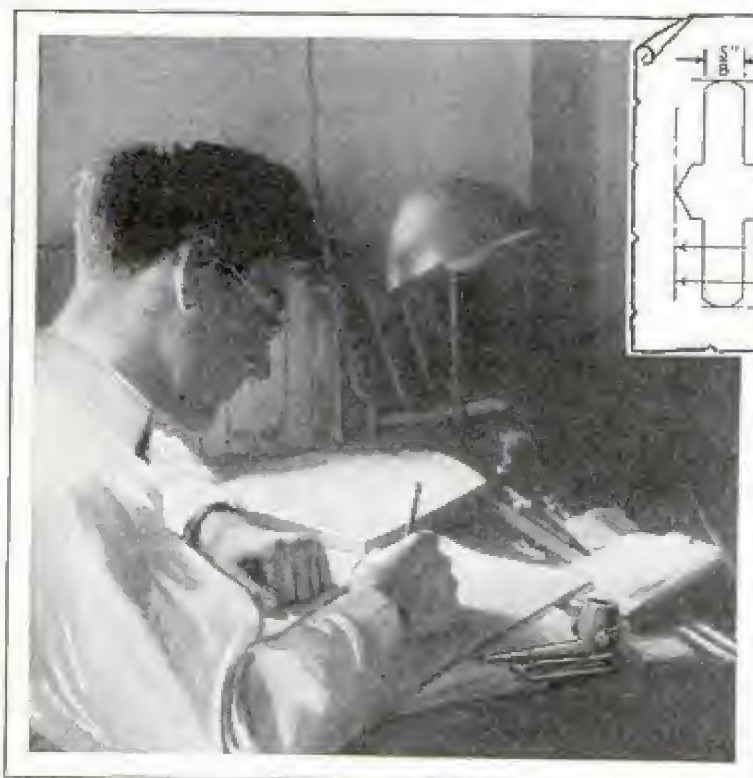
Cut out a thin cardboard pattern or template to the shape and size shown in the drawing. Lay this down on the copper and trace around it with the point of a scribe or sharp pencil. Cut out the copper with a pair of tin shears and then smooth down the rough edges carefully with a file.

The base, or flaring part, which is 2 in. wide at the end and 4 in. long, should now be hammered carefully with the ball end of a light ball-peen hammer. Turn the piece over and hammer the "neck" on the opposite side, also the wings; then turn the piece over again and hammer the other side of the wings up to the pointed end. The piece is turned over because, as may be seen from the drawings, that part

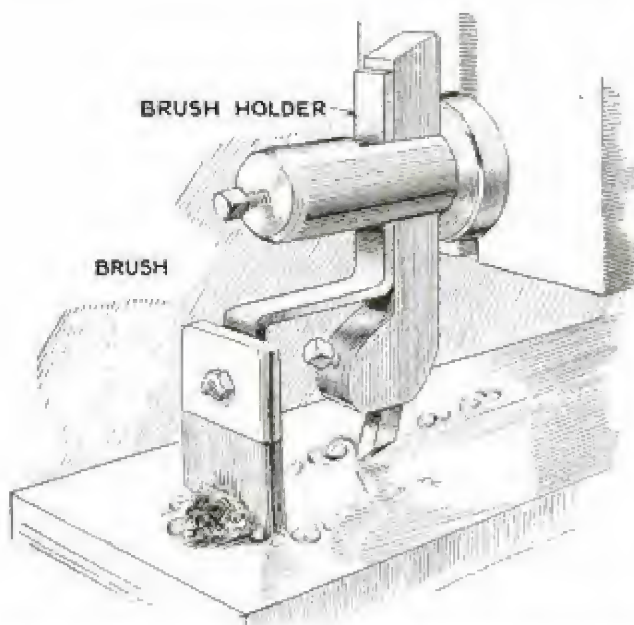
of the neck which is on the same side of the stock as the hammered part of the base will form the underside when the holder is bent to shape. Drill two small holes, in the positions shown, for a rivet to hold the parts together.

Place an old broomstick in the vise and, with the aid of the hammer, bend the neck and wings around it, then place a 40-penny nail just under the wings and bend these sharply upward, thus forming the holder for the bowl of the pipe. Now lay the pieces across the broomstick and carefully bend the neck back on the base until the rivet holes come together. The neck and base are then riveted together with a brass escutcheon pin.

To finish the job, get five cents' worth of liver of sulphur at the drug store. Dissolve this in a tray of water and, after washing the pipe holder thoroughly with soap and water, immerse it in the solution until it turns a reddish-brown color. Wash it off and allow it to dry, then polish and lacquer it. A good make of banana oil will answer as a lacquer, if you are unable to procure a regular metal lacquer. The oil or lacquer may be applied with a brush.



Holder That Will Keep the Pipe in Upright Position and Prevent Spilling of Ashes over Desk or Table



Small Brush Attached to Planer Keeps the Surface of the Work Clean

Brush Holder for the Planer

It is well to know just how a tool is behaving on a big job, but when planing cast iron it is impossible to see clearly, owing to the cuttings which collect on the surface of the work. For this reason a hand brush is often used to clear the cuttings away. Brushing the machined surface, however, is awkward, and sometimes involves some danger. One planer hand sawed the handle off a brush and fastened to it a length of strap iron, which he attached to the tool as shown in the drawing. With each stroke of the tool the cuttings were brushed away.

Punching Holes in Sheet Metal

One of the problems of a sheet-metal shop is to punch clean and accurately sized holes, without excessive burr, in thin sheet metal. A hand punch is ordinarily used for work of this kind, and the punch is backed with a block of wood or lead, or occasionally with a block of steel, drilled with a hole corresponding in size to the diameter of the punch. The wood and lead blocks do not support the punch adequately, and an excessive burr is formed when anything but the lightest grades of sheet metal are punched. When a steel block is used, it is rather difficult to place the punch directly in line with the hole in the block. After considerable experimentation with various materials, I

have found that a block of "type metal" is the best material for the purpose. This is melted and molded to convenient shape and size. Burrs are kept to a minimum, and a clean, accurate hole can be made, yet the metal is comparatively soft so that the punch will not be quickly dulled.—V. C. Darby, Cedar Rapids, Iowa.

Substitute for Stickers in Advertising Local Celebration

In a small town, where the local printing shop was not equipped to print small stickers to be attached to envelopes, and where the town committee wished to patronize home industry in a campaign advertising a forthcoming celebration, the sticker effect was obtained by "overprinting" the envelopes. Envelopes already printed with the usual corner return notice of merchants, professional men and officials were collected. A notice of the celebration was printed in red ink, directly under the return notice. This not only saved the cost of special envelopes, but enabled the merchants to profit by having their names associated with the celebration.—Edgar Sherman, Tucumcari, New Mexico.

Tool Tray for the Lathe Bed

It is always a temptation for a lathe operator to place files, calipers and other tools on the ways of the machine. If a rubber tread, such as is used on auto running boards, is laid on the ways, this practice may be followed without injury to the lathe bed. The tread is tacked to a piece of three-ply wood veneer to give it the necessary rigidity.—J. Hollis Deery, Los Angeles, Calif.



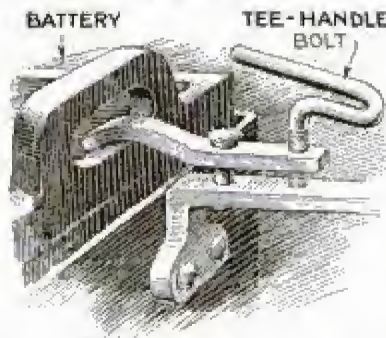
Rubber Tread, Tacked to Piece of Veneer, Makes Good Tool Tray for the Lathe Operator

Soldering Stainless Steel

Stainless steel can be soldered without difficulty so that firm, strong joints are produced. For pickled-finish sheets, muriatic acid cut with zinc is used. For polished sheets, it is necessary to dull the surface with the following solution before attempting to tin: muriatic acid, 90 parts, ferric chloride, 50 parts, and nitric acid, 3 parts, by volume. This solution should be allowed to act for from 5 to 10 minutes, or longer if necessary, and then wiped off. Tinning is done in the usual way. After soldering, all traces of acid must be removed by washing thoroughly, as any acid left on the surface will continue to attack the metal. Owing to the low thermal conductivity of the metal, it is advisable to use a large soldering iron in order to heat the steel thoroughly.

T-Handle Bolt Saves Time as Substitute for Setscrew

For use on delivery cars and trucks, where storage batteries must be removed frequently for charging and overhauling,



it will be found convenient to replace the setscrews that hold the battery-box clips down tight, by T-handle bolts as shown

in the illustration. By doing this, the need for a wrench to tighten and loosen the screws is entirely eliminated, as it can readily be done by hand. It has been found similarly advantageous also to substitute T-handle bolts for setscrews on brake adjustments, tire racks, and in places where oil and grease plugs are used.

Durable Homemade Putty

You can make a durable and thoroughly efficient putty by adding 1 lb. of white lead and enough boiled linseed oil to 10 lb. of whiting to make a mixture of doughy consistency. Add $\frac{1}{2}$ gill of the best olive oil you can get and mix it in thoroughly.—E. J. Cutting, Marilla, N. Y.

Auxiliary Ice-Box Lid, Resembling an Inverted Box, Saves Considerable Ice

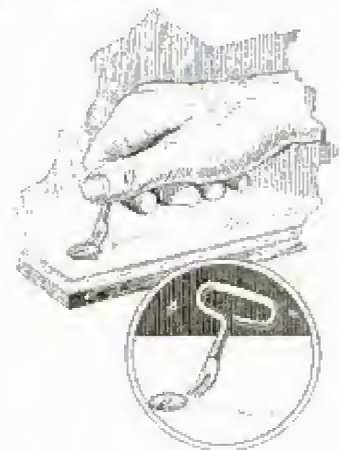


Auxiliary Lid for the Refrigerator

When the iceman leaves a block of ice that is too large for the ice box, the lid of the refrigerator cannot be closed and the ice will melt very quickly. To eliminate this waste, I made an auxiliary lid to fit over the regular lid, as shown in the photo. This increased the size of the ice compartment so that I never had to bother about the lid not closing. This lid is also handy when going away for a few days as the box can be well packed with ice. The lid shown in the illustration is hinged, but this is not essential, as an ordinary wooden box of suitable size may be used for the purpose.—Harry Moore, Hamilton, Ontario, Can.

Thumbtack Puller

For loosening thumbtacks the illustrated device, which is made by cutting off the end of a can opener, will be found convenient and quite saving on the finger nails. The prongs should be bent over a little as indicated. To remove a thumbtack insert the prongs under the head and push down on the key.—Louis Andrews, St. Louis, Mo.



Sheet brass should be inclosed in a large wrought-iron pipe, closed at one end, when being annealed.



Reclaiming an Eight-Foot Mass of Steel, Frozen in a Ladle, by Means of an Oxygen Lance and a Cutting Blowpipe

Ladle of Frozen Steel Cut in Two with Oxygen Lance

It is not generally known that the oxy-acetylene process can be used to cut masses of iron and steel of almost unlimited thickness. At steel mills the breaking up of salamanders and the removal of furnace spills have been long, expensive operations, but such problems are now successfully solved by the use of an oxygen lance in conjunction with an oxy-acetylene cutting blowpipe. The photo shows a 65-ton ladle of frozen steel, 8 ft. high, being cut to handling size. A delay in pouring, brought about by a breakdown of the crane, caused this molten mass to freeze solid in the ladle. Its reclamation presented a real problem to the manager until he was assured that it could be handled by the oxyacetylene process. The ladle was first broken away, exposing the solid mass of steel. While this was done, an oxygen lance was rigged up. It consisted merely of an 8-ft. piece of $\frac{1}{8}$ -in. steel pipe connected to a source of

oxygen. Pressure was controlled by a regulator on a manifold to which several oxygen tanks were connected. A length of hose connected the steel pipe to the manifold. The cutting blowpipe was used to start the cut at one side, and the lance was then brought into play to carry the cut down to the bottom of the mass. Meanwhile the blowpipe was moved along the line of cut at the top surface, and the lance was then raised to pick up the blowpipe cut and again carry it to the bottom. This sequence of operations was continued until the cut was completed. The two pieces thus obtained were cut by the same process into smaller pieces of such size that they could be placed in the furnace and remelted.

Tool for Cutting Open Pasteboard Boxes

Pasteboard cartons, sealed with strips of heavy adhesive paper, are usually opened by means of knives, screwdrivers, etc., but such tools are not especially adapted to this purpose, as the narrow, sharp point is likely to be pushed too far into the box, with resulting damage to the merchandise. A special tool for cutting the adhesive strip can be made from an old Ford motor valve. Grind the end to a square point and bend it over at right angles as shown in the drawing. Touch the point up with a file so that it can easily tear open the paper strips. Its shape makes it impossible for the point to suddenly slip too far into the box. Nor is it easily lost for, when not in use, it is set on the flat end so that it can be easily seen.—Frank W. Bentley, Jr., Missouri Valley, Iowa.



☛ Soapy water, applied over joints in gas or pressure pipes, will locate leaks.

War Veterans Will Like This House



WILD beasts, rain, a torrid sun, enemies waiting to pillage and kill, zero weather are some of the hazards man has had to protect himself against as a home owner. The necessity for defense and self-preservation not only influenced the plan and style of primitive houses, but when you survey the history of home building, it is surprising to note how many of the early methods of defense have been carried down into our present-day architecture as style features.

From one end of Europe to the other you'll find hundreds of castles built with round towers. A tower at each corner of the chateau, two more flanking a moat and smaller towers at convenient places where yeomen could defend their lord and lady by pouring molten metal on attacking enemies. Towers were always a part of a castle plan. In later and more peaceful years, the tower was retained as a vital part of the seigneur's chateau, not for defensive purposes, but because it added a note of distinction.

During the great war, many American doughboys sought refuge from shrapnel and shell in a Normandy tower or others like it. Smaller houses of peasants followed

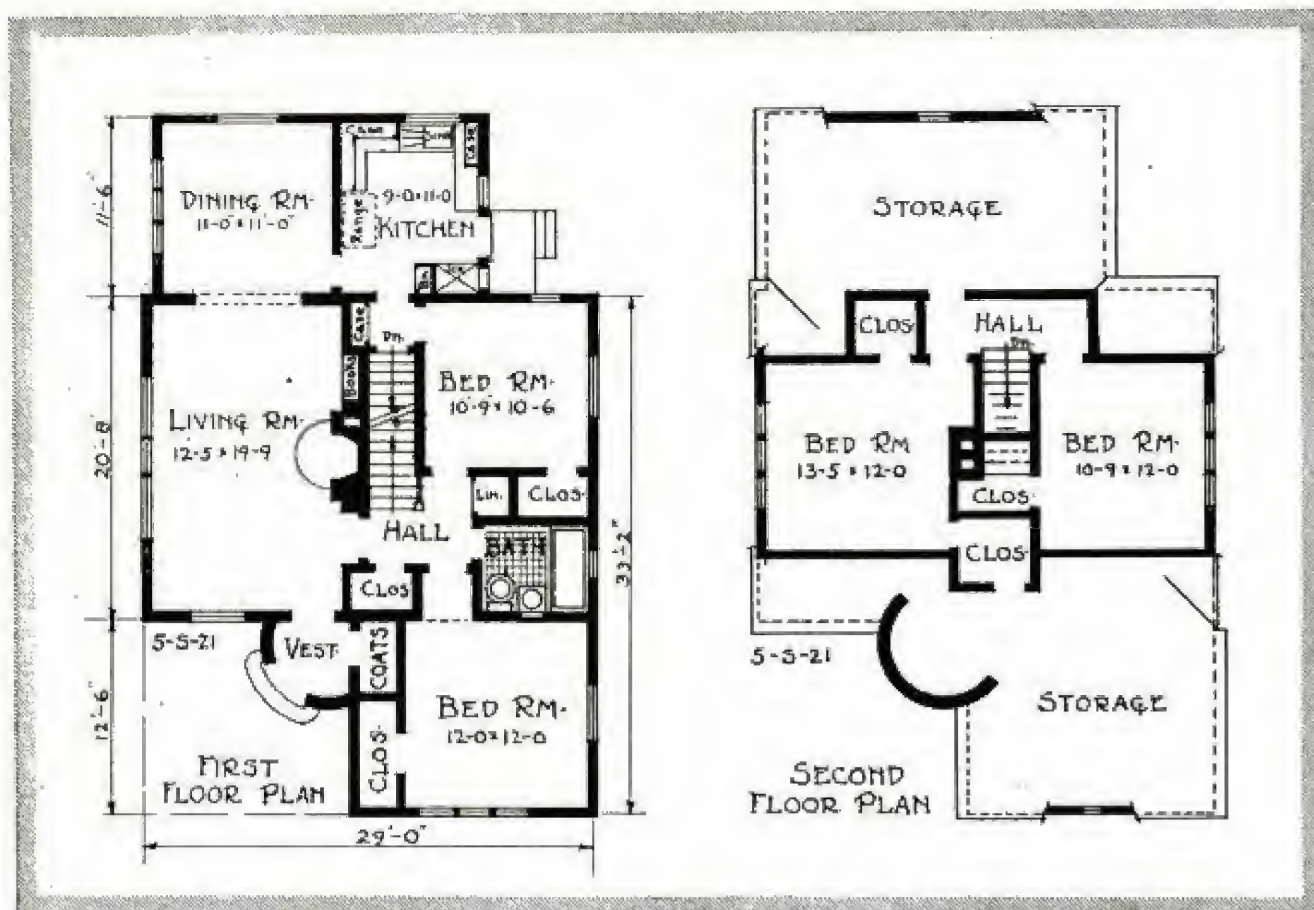
the style of their masters, so that today, when we speak of Normandy, we automatically think of tower houses.

Usually the early towers contained circular stairways from one floor to another. Even today American houses patterned after the Normandy tower idea feature circular stairways; but aside from this circular stairway, the tower itself introduces a highly decorative feature into modern house design. Porches, dormer windows, streamlines, slip-fast roofs have done much to relieve American houses of what otherwise might prove a monotonous appearance when four plain walls and roof are erected for shelter.

It is this relief of monotony that makes the Norman tower so valuable architecturally. A well-designed Norman house simply cannot look commonplace, monotonous, or "just another house." By introducing a tower into modern small-house designs, you bring a curved surface into contrast with the vertical and horizontal sidewalls, and this combination adds interest and variety to the exterior.

Normandy tower houses are growing in popularity with American home builders. We are glad to show you a new tower-

Popular Mechanics Magazine will supply readers a one-sheet blueprint of any house appearing in the magazine for \$1.



type design this month, prepared especially for Popular Mechanics readers. This is a small house nestling close to the ground. In fact, so small that a circular stairway is not practical, although the tower is none the less useful for storage purposes.

The house is planned for a forty-foot lot. It would look well on a corner lot. Construction is frame with stucco on metal lath, or tile with stucco, or white-washed brick. There is a full basement and complete insulation.

The plan calls for five rooms on the first floor, or complete bungalow equipment. On the second floor are two more bedrooms, abundance of closet space and two exceptionally large storage rooms.

The gable ends of the house are of wide siding or shingle in natural brown finish. The half timber on the tower shows a small overhang, supported by brackets or corbels.

Casement windows throughout carry out the spirit of Normandy style, and a heavy beamed ceiling in the living and dining rooms maintains an old-world tradition. The fireplace is built of fieldstone with a heavy beam for a mantel. The roof may be asbestos shingle, slate or cedar shakes.

There is everything in this house average folks require in the way of sound construction, style, and modern equipment, all at prices within the capacity of the average pocketbook. The designer says \$6,000 should build this house under normal conditions. Prices vary, depending upon location, however. Under any condition, this house offers large value at moderate cost.

It is a plan, too, that lends itself to later enlargement, when the needs of a growing family demand more space. Without destroying the charm of the house, the rear roof can be raised and the second-floor storage space turned into one very large or two small bedrooms; or, as an alternative, the kitchen water pipes and sewer connections can be extended upstairs and one end of the storage space turned into a second bathroom and the other used as a bedroom, serving room or playroom.

PLAN BOOK FOR READERS

A NEW BUNGALOW BOOK: Sixteen selected low-cost bungalows in popular styles, at prices ranging from \$5,000 down to \$2,000. Each house fully described and illustrated. Send ten cents in stamps to cover mailing.

Dealers are ready with "Yankee" Tools for Christmas



To bore holes for screws, a man needs a "Yankee" Automatic Push Drill No. 41—with eight sizes of drill-points, $\frac{1}{8}$ " to $1\frac{1}{4}$ ". Price, \$2.60.



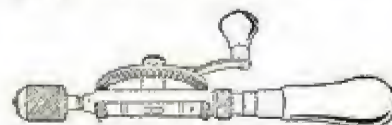
"Yankee" No. 15—a ratchet driver, has thumb-turn on blade for starting wabby little screws with thumb and forefinger. Price (4 in. blade), 80c.



No. 90 is a husky "Yankee" plain screw-driver that stands all sorts of use and abuse. Price (8 in. blade), 75c.

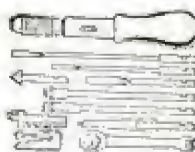


The finest tool on earth of its kind is "Yankee" Ratchet Bit Brace No. 2100. Price (10 in.), \$8.20. Lucky man, who gets a "Yankee" Bit Brace.



"Yankee" No. 1530 Ratchet Hand Drill (above), and No. 1555 Ratchet Breast Drill are fine gifts for motorists. These drills have five ratchet adjustments; they work where others can't. Price: No. 1530, \$5.25; No. 1555, \$11.00.

"Yankee" Tool Set No. 105—ratchet tool holder with nine attachments. For the man who works on radio and home electric appliances. Price, \$3.25.



MEN take pride in ownership of "Yankee" Tools! Ingenious . . . interesting! Give a man—or boy—a "Yankee" Tool and you have made a fine gift. Your hardware man is expert in knowing what tools to give a mechanic; what tools the handyman wants for the home workshop.

Every man wants this "Yankee" Spiral Ratchet Screw-driver No. 30-A. Drives all sizes of screws, quick and easy—simply by pushing on the handle. Price, \$3.00. Three sizes of bits included.

Three different size screw-drivers in one.



"YANKEE" TOOLS

MAKE BETTER MECHANICS



NORTH BROS. MFG. CO., Lehigh Avenue, Philadelphia, U. S. A.

Readers of Popular Mechanics, who like to own good tools, are invited to send this coupon for "Yankee" Tool Book (free) illustrated with action pictures of "Yankee" Tools in use, showing how these ingenious tools save time and labor.

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- 2** All Studebaker automobiles which are sold as **CERTIFIED CARS** have been properly reconditioned, and carry a 30-day guarantee for replacement of defective parts and free service on adjustments.
- 3** Every purchaser of a used car may drive it for five days, and then, if not satisfied for any reason, turn it back and apply the money paid as a credit on the purchase of any other car in stock — new or used. (It is assumed that the car has not been damaged in the meantime.)

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DISSTON Circular Saws, and all other Disston Saws, are made of Disston Steel, from Disston's own steel furnaces. This steel, and the skill of Disston craftsmen, made Disston the world's foremost saw makers.

You want Disston Steel in your circular saw. There is no substitute for it. This steel takes

and holds a keener cutting edge; cuts easier, and stays sharp longer. In great lumber mills, Disston Circular Saws are standard equipment. You will find that you, too, can do better work if you use only Disston Saws in your home workshop.

Ask for Disston! Circular Saws and Band Saws, Hand Saws, Hack Saws, and Files.



Files for the Wood Worker

Disston Cabinet Files (fine teeth) for smoothing and finishing wood surfaces, easing tight doors and drawers, etc. Disston Wood Rasps (coarse teeth) for rough and fast cutting, enlarging holes, etc. Half-round 8" Cabinet File, 65c. Flat 8" Wood Rasp, 50c.



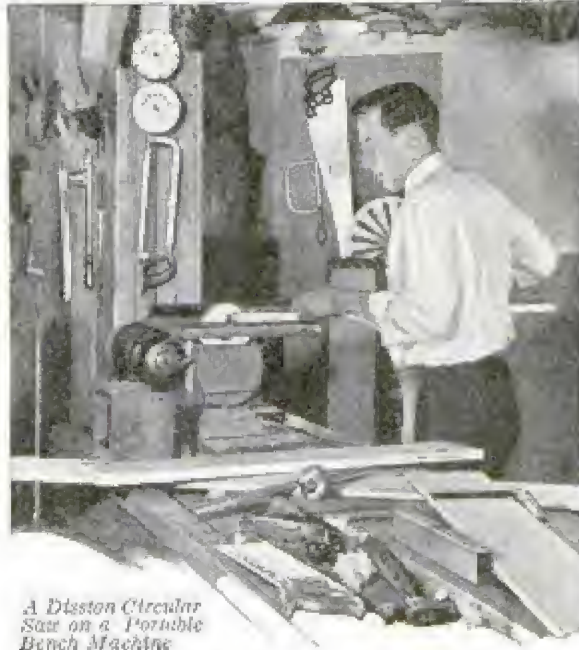
Handiest of Pocket Levels

For truing up construction work, levelling shelves, etc., use a Disston Featherweight Pocket Level. The lightest and handiest level made. Length, 9"; weight, 2 oz. Aeroplane aluminum. Three proved glasses. \$1.25.



For Cutting Dovetails, etc.

Wherever the finest possible joint is needed, and for dovetailing, pattern making, etc., use a Disston No. 68 Dovetail Saw. Blade extra thin, with fine teeth. The 8" blade, 17 points to inch, is most popular. \$1.60.



A Disston Circular Saw on a Portable Bench Machine

TO sharpen small circular saws, you need a filing clamp or vise; the proper files, and a saw set, or an anvil and hammer, to spring the teeth. The Disston No. 7 Circular Saw Filing Vise is handiest, taking saws from 4" to 16". On cross-cut and combination saws, use Disston Taper Files, 6" or 7"; on circular rip saws use Disston Mill Files, 6" or 7", with one round edge.

First joint the saw, getting all teeth same length. Turn saw backward by hand on mandrel, holding emery stone lightly against tops of teeth until all are touched.

Then put saw in vise and set the teeth, using a Disston No. 18 Triumph Saw Set (Illustrated; \$1.50). Be careful not to carry the set down too far on the teeth. Follow the original set of your saw. Note that one tooth is set to right and the next to left.

Next file the teeth as near to their original shape as possible. Keep all gullets of same depth and width. Bevel teeth alternately, following original angles. In filing, do not reduce length of teeth; simply bring them up to a sharp point. Bevel on both face and back should be about one-third the length of the teeth.

On a combination novelty saw, which cross-cuts, rips, and miters, do not set the raker teeth; set only the scoring teeth. No teeth of a hollow-ground combination saw should be set. Do not bevel raker or cleaner teeth, but file them straight through.

Your hardware dealer has in stock, or can get for you quickly, Disston Circular Saws for any machine.



"The Saw Most Carpenters Use"

The two handiest saws for the home workshop are the 26-inch 8-point for cross-cutting, and the 26-inch 5½-point for ripping. You will need these on almost every job. The popular "D-8" lightweight cost \$3.45. Many other styles and sizes available.



Band Saws for Better Work

Disston "Thin Gauge" Narrow Band Saws are 2 to 3 gauges thinner. They run better on machines with wheels up to 26" diameter. Saw 9' 8" long, ¼" wide, 25-gauge, brazed, \$2.03. Other sizes in proportion.



Disston Combination Saw

This type of Circular Saw, known as a Combination Novelty Saw, does cross-cutting, ripping, and mitering equally well. It is made either flat ground for general work or hollow ground for smoother cutting.

DISSTON

Makers of "THE SAW MOST CARPENTERS USE"



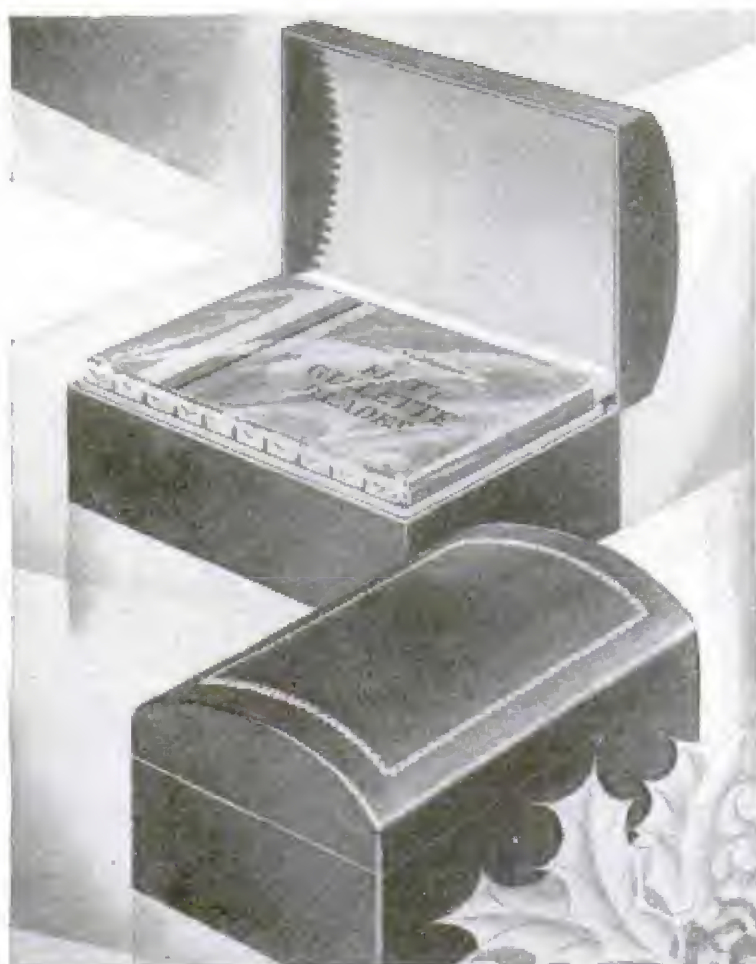
"Disston Small Circular Saws and How to Use Them" is a new bulletin which tells how to operate and refit saws. It will be of interest and value to every owner or prospective owner of a small electric bench saw outfit. The coupon will bring it to you.



Henry Disston & Sons, Inc., Philadelphia, U. S. A.
(In Canada, address Henry Disston & Sons, Ltd., Toronto)
Please send Bulletin on Circular Saws, and other data.

Name and Address

How to be *Generous* to a man at Christmas



Five Dollars

JUST how does the Gillette Fifty Box qualify as the ideal Christmas gift for a man? Here's how—on these eight counts:

It is practical . . . Man, famous for his practical mind, insists on useful gifts.

Yet he probably wouldn't buy this for himself . . . From long habit, he is used to getting his blades in packs of five and ten. This will be a new and refreshing idea for him.

He'll be sure to use it . . . Blades are a daily necessity in every man's life. The Gillette Fifty Box is the most convenient way to have them.

It is personal . . . It's all to himself, for his own intimate, bathroom use.

It is good looking . . . Packed, as you see, in a

metal box, velvet lined, with a spring-hinge cover. Blades are enclosed in brilliant Cellophane.

It is truly generous . . . With fifty smooth, double-edged Gillette Blades in easy grasp, a man can look forward to more continuous shaving comfort than he has probably ever enjoyed before in his life.

It will last well beyond the Christmas season . . . For months his mornings will be free from all thought of buying Gillette Blades.

It is reasonable in price . . . Five dollars buys this *ideal* gift. On sale everywhere.

Gillette

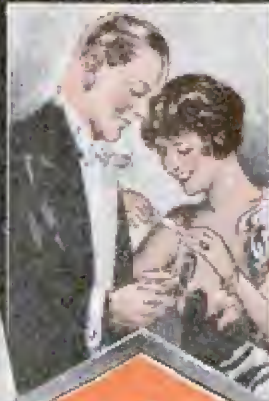


Give him shaving comfort in abundance with the famous Fifty Box of Gillette Blades

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Direct Diamond Importations and large volume buying for both our National Mail Order business and our Chain Store system enable us to offer you superior quality genuine diamonds, fine standard watches and exquisite jewelry at saving prices which are beyond comparison. All of this with no extra charge for the added convenience and advantage of dignified, liberal credit.

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DT1—Newest Butterfly design, of 18K Solid White Gold engagement ring set with sparkling, genuine blue-white diamond. \$4.08 a mo.

\$29.50

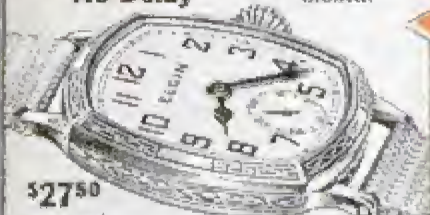
DT28—Gorgeous hand engraved 18K Solid White Gold "Bridal Blossom" wedding ring; 5 very genuine blue-white diamonds. \$2.37 a mo.



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DT23—Modern, square-prong, engagement ring in new "step" design 18K Solid White Gold set with specially selected dazzling, genuine blue-white diamond. \$6.16 a month.

No Red Tape
No Delay



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DT31—Nationally known ELGIN or WALTHAM! Handsomely engraved new style case. Guaranteed Elgin or Waltham movement. Warranted 14K White or Green Gold filled 25-year case. Latest style flexible mesh wrist band to match. \$2.21 a mo.



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DT22—Gentleman's massive, hand engraved ring of 14K Solid White Gold imported black Onyx with a genuine diamond and any carved initial or emblem desired. \$2.21 mo.

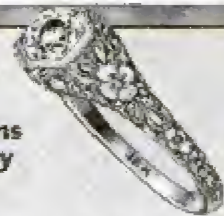
IT'S A BULOVA
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DT5—Nationally advertised guaranteed 15-jewel Gent's BULOVA watch. White Gold filled case, "dust-tite" protector; radial dial and hands; latest style woven wrist band to match. \$2.59 a mo.

12 Months to Pay

\$42.50



DT27—

"Bridal Blossom"—Hand pierced lace design engagement ring of 18K Solid White Gold, genuine blue-white diamond of rare brilliance. \$3.46 a mo.

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DT12—Dazzling cluster of 7 perfectly matched genuine blue white diamonds; hand pierced 18K Solid White Gold lady's mounting. Looks like \$7.50 solitaire. \$3.96 a mo.



\$29.50

DT26—Latest style, modernistic effect 18K Solid White Gold lady's ring; very genuine blue-white diamond. \$2.37 a month.

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DT10—Gorgeous lace design hand pierced 18K Solid White Gold dinner ring; 3 fiery, genuine, blue-white diamonds; 2 French-blue sapphires. \$3.48 a mo.

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DT8—Diamond wrist watch, 14K Solid White Gold engraved case; 2 genuine diamonds, 8 emeralds or sapphires. Guaranteed 15-jewel movement. Pierced flexible bracelet with sapphires or emeralds to match. \$3.04 a month.

\$24.50



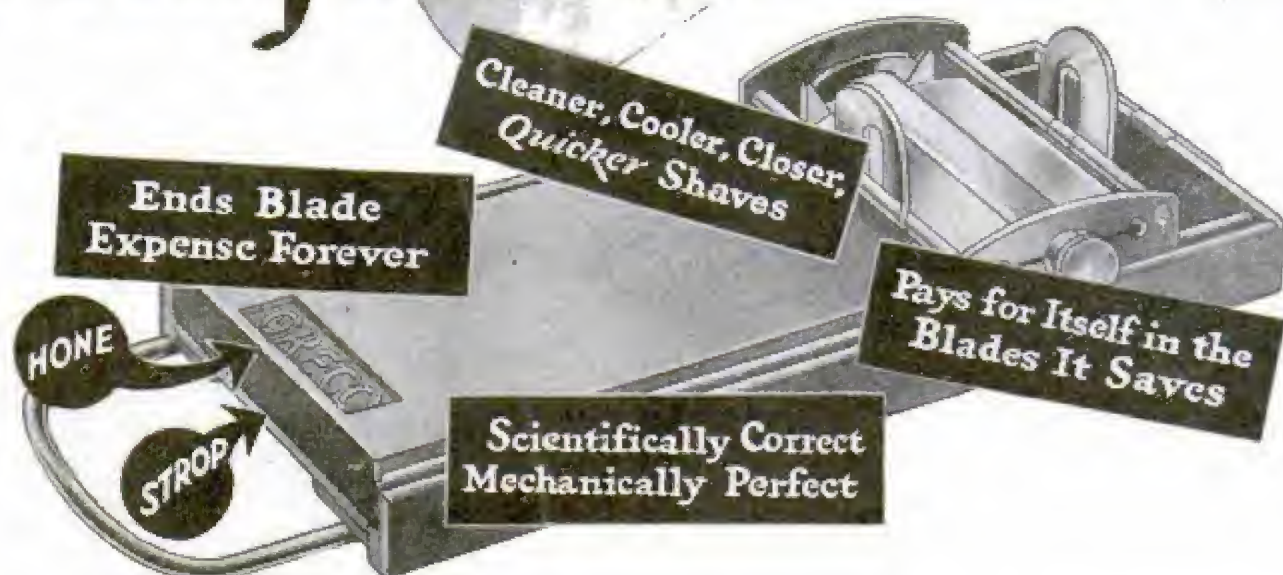
DT9—The "Princess Pat"—14K Solid White Gold engraved case, guaranteed 15-jewel movement. Engraved genuine "Wristocrat" flexible bracelet to match. \$1.96 a month.



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DT19—Nationally known 15-jewel WALTHAM movement; 20-year warranted engraved White Gold filled, 12 size, thin model, deacon case. Tested and regulated. White Gold filled knife, fine Waldemar chain. All complete in handsome gift case. \$2.21 a mo.

Shave All Year with just ONE Blade



EVERYBODY knows that a safety razor maker could afford to give away the holder and grow rich on the profits from blades. Because one good and one or two indifferent shaves are all that you can expect from even the best blade. Most men have to use a new blade every day. At cut rate prices for blades this amounts to \$25.19 a year. If you get two shaves from a blade you pay \$12.60 a year for new blades;

and for three shaves your yearly blade bill comes to \$8.40; and you *don't* get "head barber" shaves.

Scientific Invention Ends Blade Expense

There has never been a device for Gillette type blades like the GRECO Sharpener. It actually lets you get better shaves all year from ONE blade than you would get from 365 new blades.

You know that the only way to sharpen an edged tool is to use a STONE . . . a Grindstone, a Whet-

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You know that a razor needs to be honed when it is dull.

That's just exactly what the GRECO Sharpener does. With a few quick strokes it HONES a Gillette type blade on a special Pike hone to form NEW cutting edges . . . and then, on fine shell leather, STROPS the new edges to shaving keenness.

It does this to *both* sides of both edges automatically without removing the blade from the carriage. Beautiful, simple . . . lightning quick; nothing to get out of order or rust. Precision built of heavy bronze-brass, fully plated.

Read What a Few Users Say

H. S. W. writes: "I have used but 3 blades in 18 months since I got your GRECO Sharpener. One blade cracked and my wife used the other to scrape paint off the window or I would

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If the GRECO Sharpener will do for YOU what it does for others you want it. For it pays for itself every six months in the blades it saves and gives you better shaves as well. So I want to send you one . . . on 30 days FREE trial. If you don't like it, return the GRECO Sharpener in good condition and I'll send back every cent you paid. For I'd rather have your good will than your money, if you're dissatisfied. But you won't be. So clip the coupon, pin your check or a \$5. bill to it and mail it to me today.

Accept My 30 DAY FREE TRIAL OFFER

Send today for a GRECO Sharpener; use it in your own home for 30 days. I Guarantee that you will be delighted. If you're not, just return the GRECO SHARPENER in good condition and I'll return your money without argument. If I knew of a fairer offer I'd make it to you.

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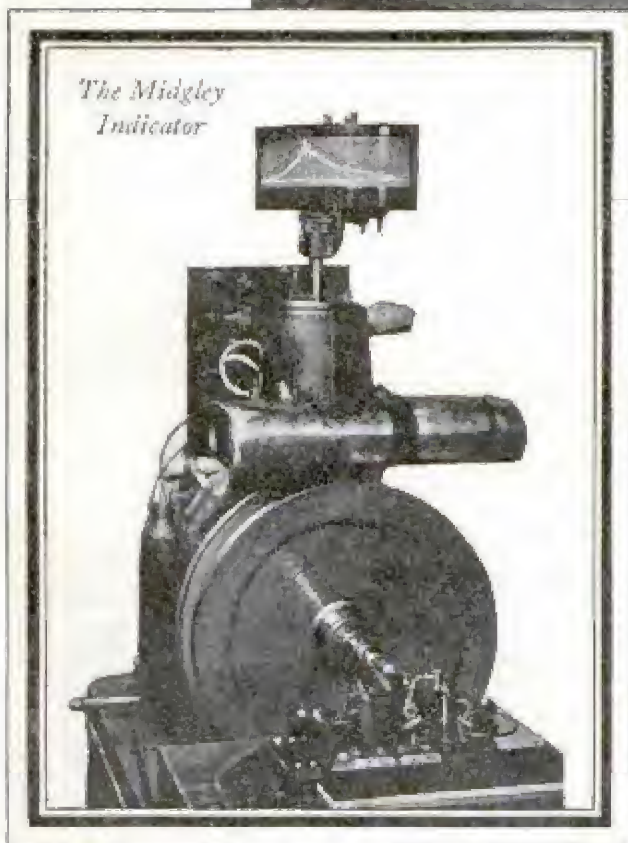
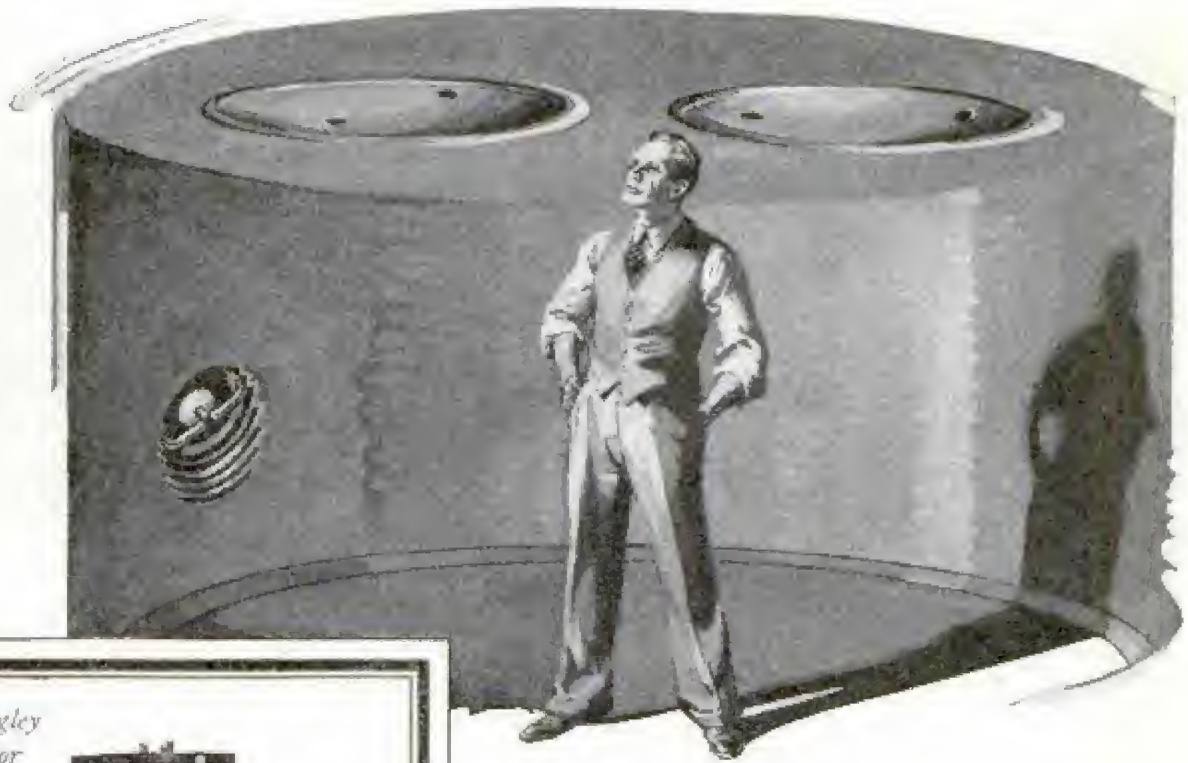
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NEW YORK, N. Y.**

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The indicator is an ingenious and sensitive mechanism which records the pressure inside the cylinder while the engine is running. By studying these pressures the scientists found out exactly what caused an engine to "knock."

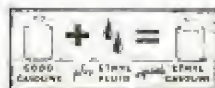
Gasoline, even the best, they found, explodes too fast when compressed beyond certain limits. So they developed Ethyl fluid, which controls the combustion rate under increased pressures.

Today Ethyl Gasoline—good gasoline to which Ethyl fluid has been added—has created a new standard of motoring efficiency and comfort. It has made possible the new so-called "high-compression" cars, and it improves the performance of older cars.

Try Ethyl in your car.

Ethyl Gasoline Corporation, 25 Broadway, New York City; 56 Church Street, Toronto, Can.; 36 Queen Anne's Gate, London, England.

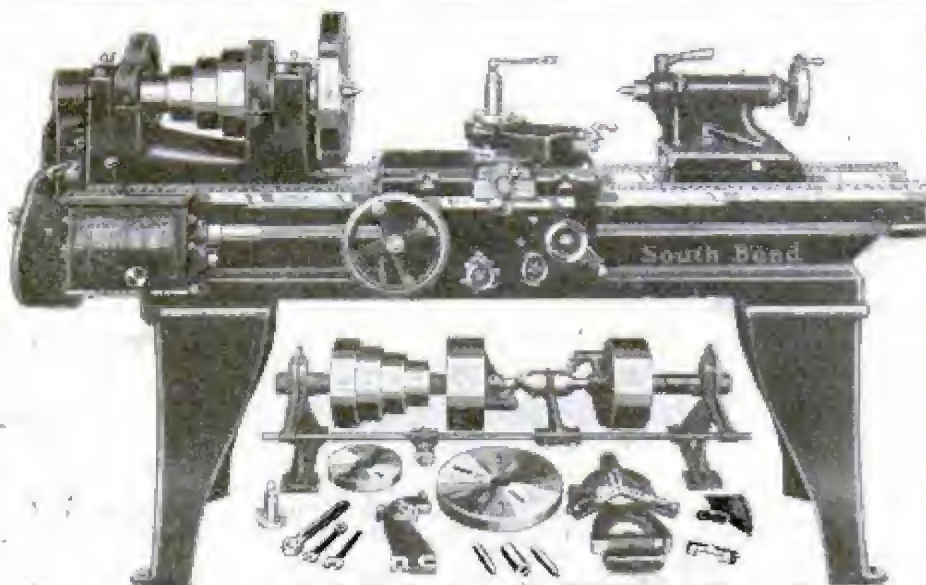
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NEW MODEL SOUTH BEND

LATHE BUILDERS FOR 24 YEARS



16"x6" Quick Change Gear New Model
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96 Sizes and Types of New Model South Bend Lathes

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*Manufacturing Plant
Tool Room
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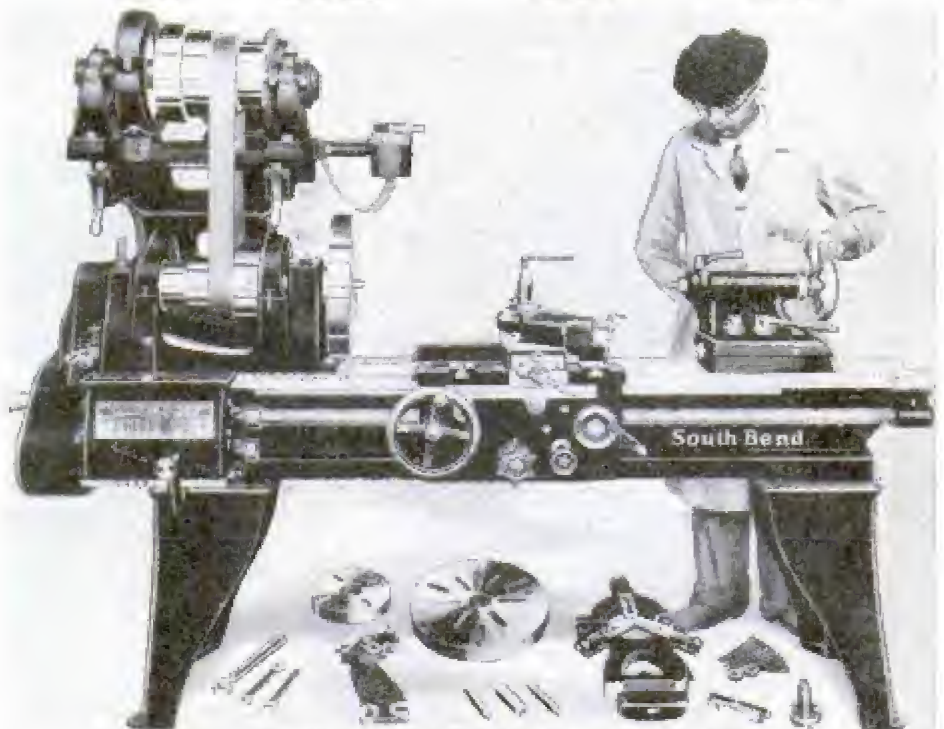
*All Classes of Preci-
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Machine Work.*

Prices of Popular Sizes of Quick Change Gear Lathes with Lathe Equipment

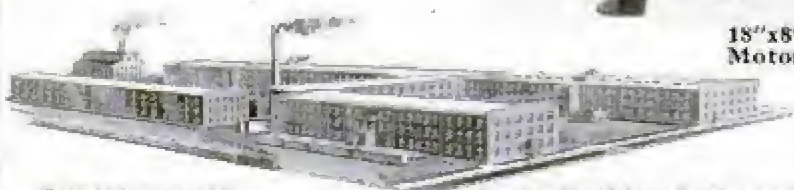
Size of Lathe	Shipping Weight	Countershaft Drive	Silent Chain Motor Drive
9"x3"	490 lbs.	\$294.00	\$413.00
11"x4"	725 lbs.	\$359.00	\$526.00
13"x5"	1110 lbs.	\$443.00	\$645.00
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16"x8"	2035 lbs.	\$638.00	\$846.00

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—used in 78 countries



18"x8" Quick Change Gear Silent Chain
Motor Driven Lathe.....\$1049.00



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Lathe Builders Exclusively

The South Bend Lathe Works is represented by machinery dealers and importers throughout the world, who carry South Bend Lathes in stock.

SCREW CUTTING LATHES

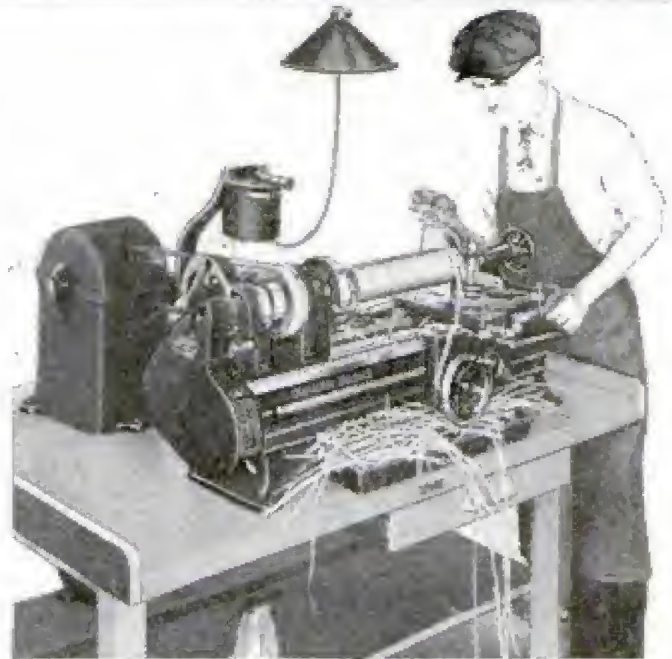
OVER 46,000 LATHES IN USE

The New Model South Bend Lathe is a back geared, screw cutting engine lathe with improvements and new features that make it the most remarkable lathe value in the world. It is practical for handling the finest and most accurate work coming up in the modern plant and shop.

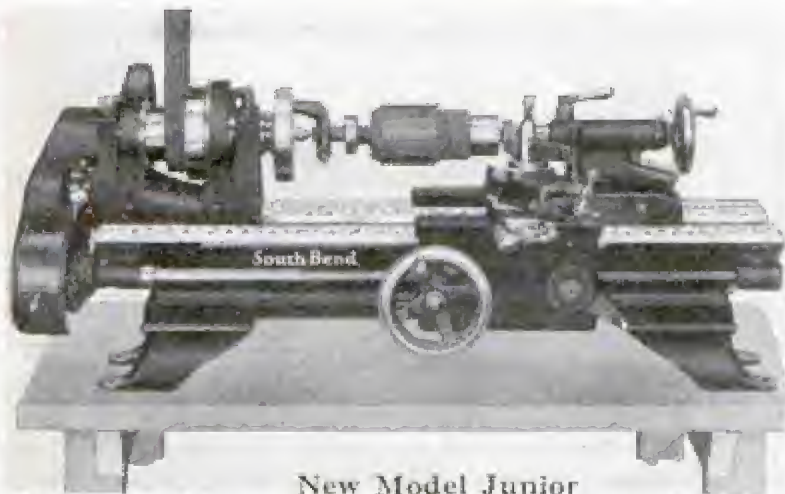
Easy Payments as Low as \$11.41 a Month

Our Easy Payment Plan allows you to install a South Bend Lathe by making one payment with the order the balance to be paid month by month the amount depending on the size of the lathe you select

Write for Catalog No. 90P which describes the Easy Payment Plan



9"x3' New Model Junior Horizontal Motor Driven Bench Lathe complete..... \$254.00



New Model Junior
9" x 3' South Bend Bench Lathe \$169
with Countershaft and Equipment
Weight 375 lbs.

Other 9-inch Junior Lathes

The Prices include Lathe Equipment

Size of Lathe	Shipping Weight	Countershaft Drive	Horizontal Motor Drive	Motor Drive Without Motor
9"x2½"	350 lbs.	\$163.00	\$248.00	\$165.00
9"x3'	375 lbs.	\$169.00	\$254.00	\$171.00
9"x3½"	400 lbs.	\$175.00	\$260.00	\$177.00
9"x4'	425 lbs.	\$182.00	\$267.00	\$184.00
9"x4½"	450 lbs.	\$190.00	\$275.00	\$192.00

New General Catalog No. 90A just out illustrates and describes the 96 sizes and types of New Model South Bend Lathes from 9" swing to 18" swing.

Write for this free catalog mentioning size of lathe in which you are interested and 16 page Bulletin will also be sent describing lathe in detail.

Free Catalog
Write for it



SOUTH BEND LATHE WORKS

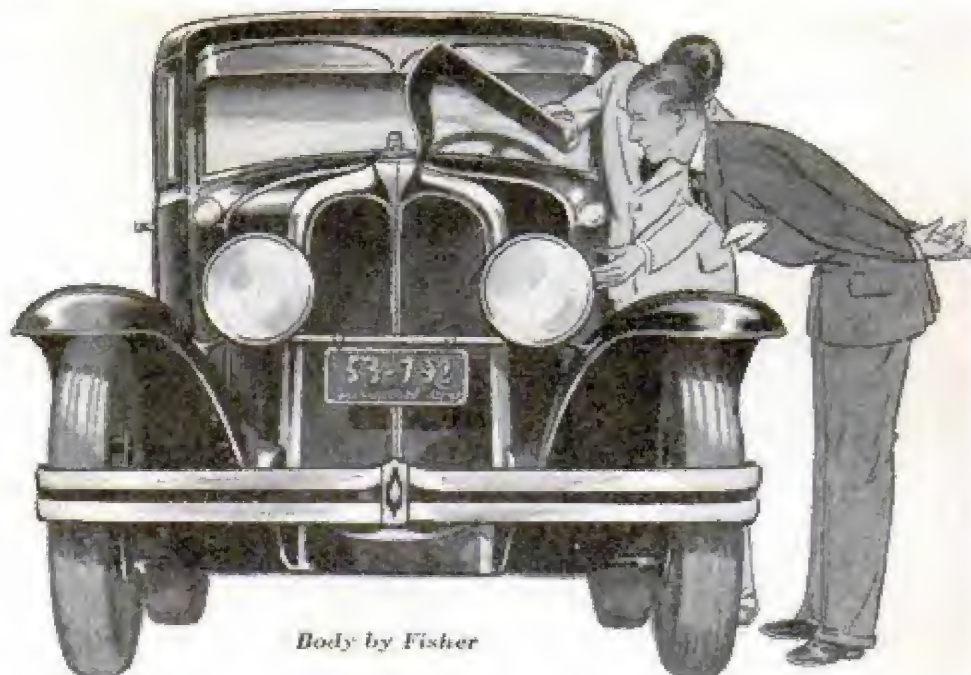
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SOUTH BEND, IND., U. S. A.

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Gentlemen: Send free postpaid () New Lathe Catalog No. 90-A () Time Payment Catalog.

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Lift the hood



Body by Fisher

and you'll readily see why the Pontiac Big Six is mechanically the greatest value in its field

If you are interested in the "works" of a fine automobile, we promise you a real thrill when you lift the hood of the Pontiac Big Six. For there you'll see the "inside story" of why Pontiac is acknowledged the greatest motor car value at its price . . .

Greatest for Power—200 cubic inch piston displacement, large L-head engine developing 60 brake horsepower at moderate engine speed—more power with less wear and strain.

Greatest for Speed—Ahead of anything in its class—proved by the "fifth wheel," the most accurate speed measuring device known to automotive engineers.

Greatest for Snap—Gets away like a dart—swiftest acceleration of any low-priced six—again proved by the "fifth wheel."

Greatest for Safety—Self-energizing internal-expanding four-wheel brakes—noiseless, unaffected by weather. Full tread axles—front and rear. Rugged hardwood-and-steel bodies by Fisher. Foot-controlled headlights, dimmed or brightened while both hands are free to guide the wheel.

Greatest for Durability—Prolonged top performance and longer life due to full pressure positive lubrication at all speeds—crankcase ventilation preventing dilution of oil—Harmonic Balancer eliminating torsional vibration—non-squeak brake bands often good for 30,000 miles—Cross-flow Radiator with automatic temperature control—no watching, no overheating.

Greatest for Economy—Low first cost, thrifty operation, high resale value. Of 996 cars of 33 makes operated in 1928 by one large corporation, Pontiac cost one cent less per mile than any other low-priced six used!

In addition, Pontiac's long, low lines, its smart chrome plating, refreshing Duo color combinations and roomy, luxurious bodies by Fisher supply the finishing touches that mean greatest satisfaction, comfort and convenience for every dollar invested. See your nearest dealer, drive the Pontiac. You'll be amazed at how easily you can own this leader of low-priced sixes.

Pontiac Big Six, \$745 to \$895, f. o. b. Pontiac, Mich., plus delivery charges.

OAKLAND MOTOR CAR CO., PONTIAC, MICH.

PONTIAC



BIG SIX



PRODUCT OF GENERAL MOTORS



Hello boys!

Tell'em you built it with

GILBERT "Big-Boy" Tools

BOYS, here's your chance to give Mother and Dad the surprise of their lives! Build furniture, airplanes, toys, bird houses, and hundreds of other practical things. Tell Dad you'll start right in as soon as you get your Big Boy Set. Lift the lid of one of my big red brass-bound tool chests and you open up a whole new world of exciting thrills. Call in your pals. Oh, Boy! How their eyes will pop! Boy Builder's Plan Book tells exactly how each job is done. And there's a tool for every purpose.

Find out right away how smart you are with your hands. Look over my Big Boy Tool Chests and machine shop outfits at any good store. Pick out your set and start right in building wonderful things.

A.C. Gilbert

When You Buy Your Tool Chest
See that you get these
Feature Tools



LET'S GO!

Boys, want to make things hum? My brand new Motor-Driven Machine Shop is the greatest thing I've made for boys since I invented Erector. A complete scientific workshop—a combination portable lathe, demountable drill, emery wheel, scratch brush, buffing wheel, etc. And—Boy, here's news, this workshop's equipped with a $\frac{1}{2}$ H. P. Universal Motor and A. C. or D. C., with toggle switch, cord and plug. Send the coupon and get the booklet that tells you all in words and pictures.

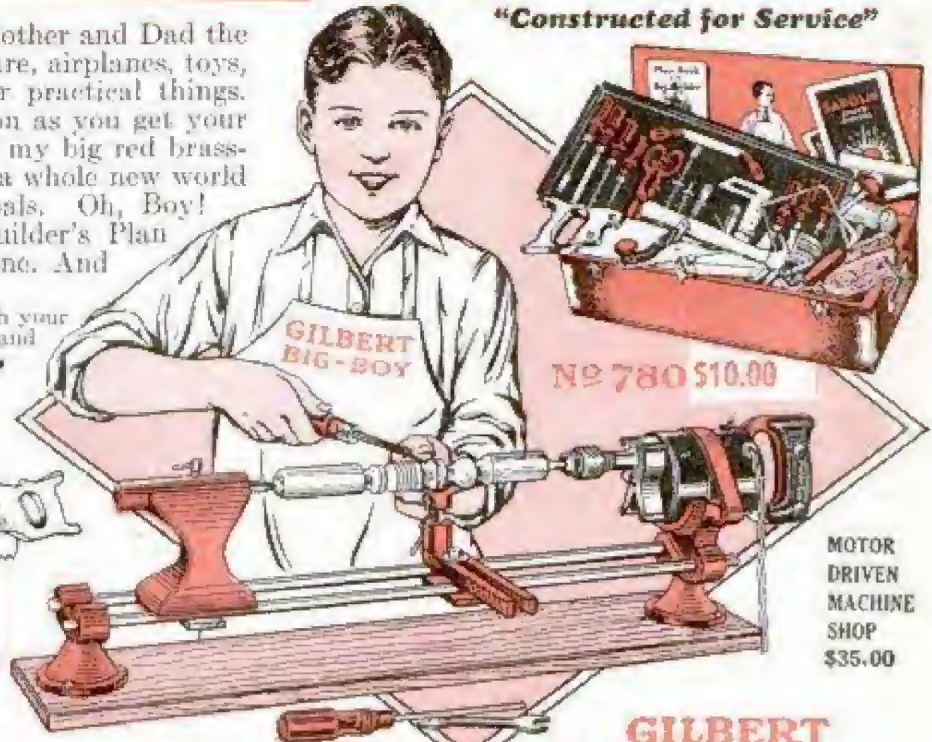
THE NEW 1929 LINE INCLUDES THESE IMPORTANT DESIRABLE FEATURES

When you are looking for a Genuine Chest of Tools, be sure to get these big exclusive features contained in the Dad's Size Chests.

1. Big Boy Tool Chests have more and better tools than other chests of equal value.
2. All metal spirit level in No. 785 and up.
3. High quality ground faced block plane in No. 765 and No. 780.
4. Bench plane, the kind that real carpenters use, in No. 785 and up.
5. Sapolin color chart, Home Manual, Plan Book and Sapolin Speed Enamel, in all Dad's Size Chests.
6. New 1929 Plan Book in all sets.
7. Carpenter's apron in No. 785 and up.
8. Drop forged hammers in Dad's Size Chests.
9. Big Boy Saws.
10. Metal Tray.
11. Big red brass-bound chest.

THE A. C. GILBERT COMPANY, NEW HAVEN, CONN., U.S.A.
Manufacturers of the Famous Erector and Chemistry Sets, Magic, Motors, Etc.

A. C. Gilbert's Radio Sports Talks. See Station Listings Page 133



BOYS!

This big (No. 780) is the treasured possession of thousands of red-blooded boys. They wouldn't swap it for a million dollars. 26 pieces in all—18 pounds of scientific fun—the kind of fun you'll never get tired of. Real he-man tools for the boy builder. Two complete books that show clearly and exactly how to build hundreds of wonderful useful things. See "Big Boy" at your favorite toy shop.

A. C. Gilbert's Free Plan Book

Send for your copy of my Plan Book, which tells how to construct dozens of interesting things, including Toys, Bird Houses, Household Utilities, Boats, Etc.

PLANBOOK and catalog describing various Big Boy Tool Chests come to your door free for the asking. Just fill out the little coupon below and mail to-day.



FREE!
Send for it!

GILBERT "Big-Boy" Tool Chests Consist of DAD'S SIZE

HOUSEHOLD TREASURE CHEST No. 780. 26 pieces of real he-man tools, including big 16-inch cross cut saw and 7 $\frac{1}{2}$ inch plane. A regular outfit. Two plan books and color chart. Packed in brass-bound chest. Sapolin speed enamel.....\$10.00

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THE DELUXE CARPENTER SET No. 790. Feature set of Big Boy line. 37 pieces including 9-inch plane, ratchet brace, 15-inch level, 20-inch cross, 18-inch rip, and dandy keyhole saws. 2 plan books and color chart. Every needed tool for master builders. Packed in big red chest, brass corners and lock. Sapolin speed enamel.....\$25.00

BOY'S SIZE

LITTLE FELLOW'S SET No. 701. Contains 11 pieces with plan book.....\$1.00

DANDY BIG SET No. 701E. The set for the beginner. Contains 12 pieces with plan book.....\$1.50

PRACTICAL YOUNG CARPENTER'S SET No. 702. 10 pieces with plan book.....\$2.50

HANDY SET No. 707. Practical set for boys, 19 pieces including plan book.....\$3.50

FAMOUS No. 765. Feature set in Boy's Size Group. Handy Set, 24 pieces. Real tools for practical service. Packed in big red chest with plan book.....\$5.00

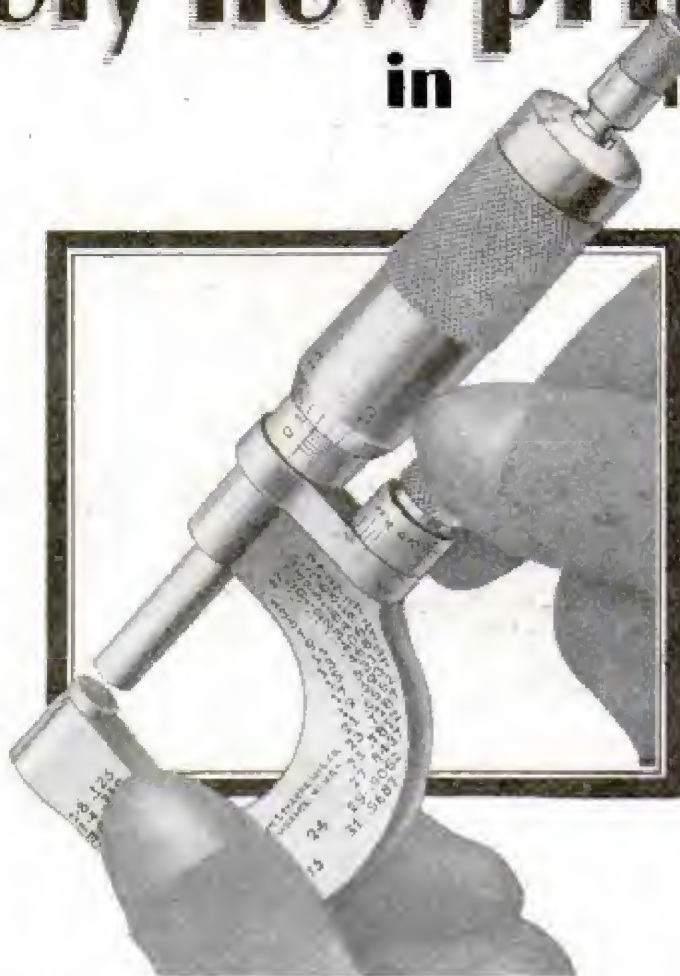
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97 ERECTOR SQUARE, NEW HAVEN, CONN.
Please send me free copy of Plan Book and Gilbert Toy Catalog.

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CITY.....

an entirely new principle in micrometers

No. 24

Range 0. to 1" by ten-thousandths of an inch.



*A better way to read
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The new Brown & Sharpe Micrometer Caliper No. 24 measures direct by ten-thousandths in a new, easy way. Ten-thousandths can be read as easily and positively as thousandths on an ordinary micrometer. Notice the widely spaced graduations on the lower thimble where the ten-thousandths are read.

Compact in design, easily used, easily read—there are no gears or intricate mechanisms to get out of order.

Ask your dealer to show you this new micrometer or write us for circular. Dept. P. M., Brown & Sharpe Mfg. Co., Providence, R. I., U. S. A.



"WORLD'S STANDARD OF ACCURACY"

BROWN & SHARPE TOOLS

*Lionel Electric Trains
are priced from
\$7.00 to \$325.00*

*Send for the FREE
Lionel Railroad
Planning Book.*



HERE'S A LIONEL ELECTRIC RAILROAD THAT ANY BOY CAN BUILD

THIS photograph tells the whole story better than a thousands words. It shows you how *Lionel Model Electric Trains* look in action! It pictures the realism of these remarkable locomotives and cars. It shows you what you can do with your *Lionel* trains and accessories this Christmas.

With such a *Lionel Electric Railroad* you learn many of the details of actual railroading, for *Lionel Railroad Systems* are true-to-life models of the big railroads of the Country.

See the new *Lionel Steam Type Loco*—electrically driven by the famous *Lionel "Bild-A-Loce"* motor—the motor that may be removed in a jiffy, taken apart and reassembled again.

Also, see the new *Lionel electric type locos*. These "Giants of the Rails" are the most powerful model electric locos ever built.

LIONEL

ELECTRIC TRAINS

Model Railroad Accessories ♦ "Multivolt" Transformers

Remember, too, that *Lionel* trains can be controlled and operated by *Lionel "Distant-Control"*—which enables you to start, stop, reverse or switch your trains at any distance from the track. This is a feature that every boy is enthusiastic about.

Write for the catalog today—it shows all the new *Lionel* models. See the *Lionel* demonstrations at your local stores.

ON THE RADIO STARTING NOV. 8th

Every Friday night, 6:30 to 7:00 Eastern Standard Time, "Uncle Don" and his *Lionel Engineers' Club* over stations WOR, WLW and WBBM. Listen-in and enjoy this wonderful *Lionel* radio program, and laugh with "Uncle Don."

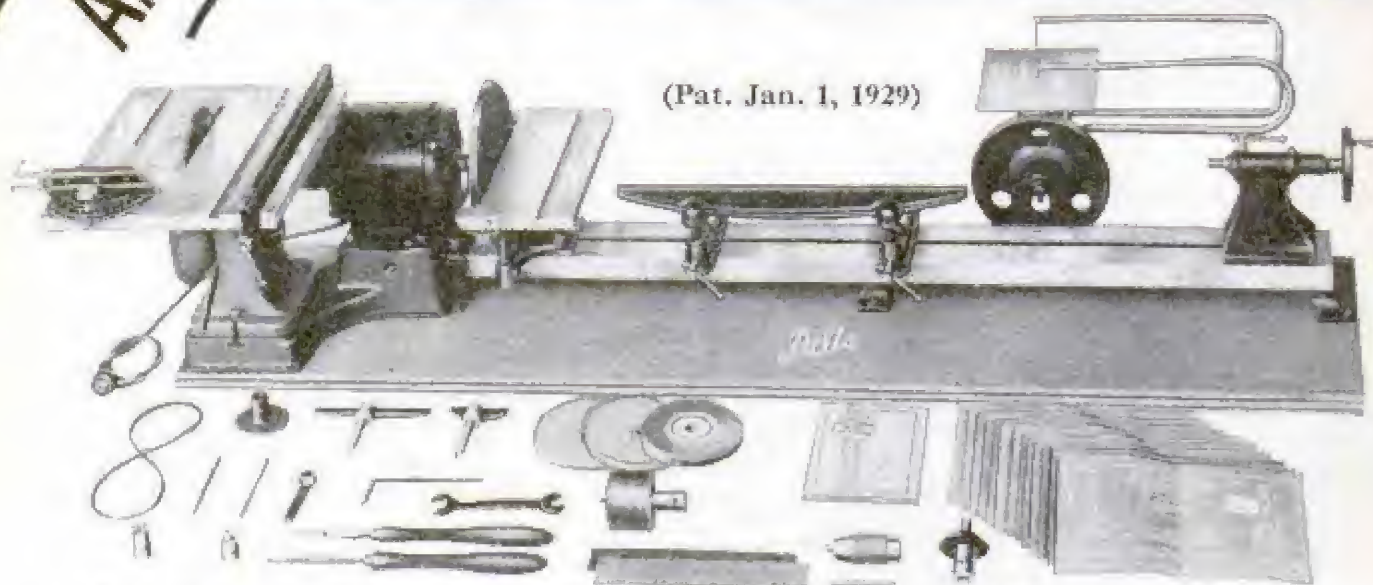
BOYS: SEND FOR FREE BOOK

FREE: Don't delay another instant. Write today for a FREE copy of the new *Lionel 46 page handsomely illustrated Railroad Planning Book and catalog*, and pick out the set you want for Christmas. The *Lionel Corporation*, Dept. C, 15-17-19 East 26th St., New York City.



THE LIONEL CORPORATION, Dept. C, 15-17-19 East 26th Street, New York City

Announcing— The NEW 1930 Models

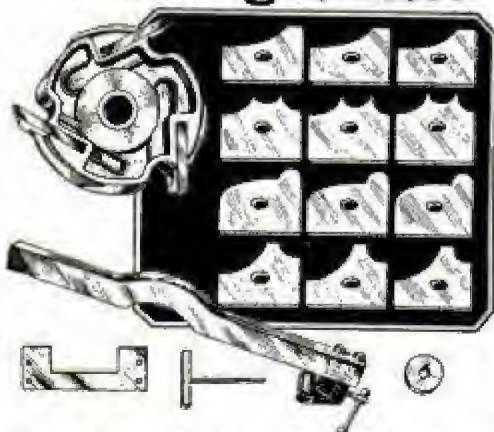


(Pat. Jan. 1, 1929)

"Delta" Electric Handi-Shop

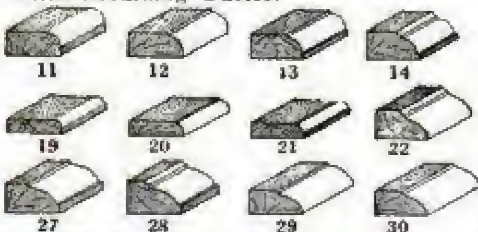
A complete motorized workshop for craftsmen including all necessary equipment for Circular Sawing, Wood Turning, Scroll Sawing, Sanding, Drilling, Grinding and Buffing. Full instructions and blue prints furnished.

New "DELTA" Moulding Cutter



Cuts Over 50 Moulding Shapes With Only 4 Sets of Blades

Interchangeable high speed blades produce over 10,000 cuts per minute at 3500 RPM. Blades require no individual adjustment. Quickly and easily locked in position. Special guide fence. Unusually low price. Below are a few of the many attractive mouldings that can be made with this Delta Moulding Cutter.



Practical Design—Dependable Quality Plus Many Exclusive Features

that's what you find in every woodworking unit bearing the Delta trademark. Craftsmen, artisans, farmers, mechanics—all who use wood in their daily labors or spare-time hobbies—are delighted with the sturdy construction, splendid efficiency and moderate cost of Delta equipment. They appreciate keenly such practical constructional features in the Handi-Shop as:

1. Two-shaft motor that permits carrying on two important operations at one time without continually dismantling set-up.
2. Heavy U-shaped Lathe Bed (no rods) guaranteed not to chatter.
3. Automatically Oiled Bronze Bearings.
4. Patented Tilting-Tables.
5. Circular-Saw Raising lever.
6. Absence of interference when sawing large pieces of lumber; and many other important improvements found only in Delta products.

10-DAY TRIAL EASY TERMS

For complete details and full description of the new 1930 Delta line, send coupon for FREE illustrated literature. You will learn also how you can try any Delta equipment for 10 days under actual working conditions at our risk. Your choice of three convenient payment plans. Mail coupon on opposite page today. It describes numerous items of interest to those who work with wood.

Delta SPECIALTY Co.

Delta Woodworking Units

for HOME CRAFTSMEN, FACTORIES,
SHOPS, CONTRACTORS AND FARMERS

The introduction of the Delta Jointer and Circular Saw Units marks a new era in moderate-priced woodworking equipment. Now, for the first time, are available sturdy, practical machines in compact, convenient form at price levels astonishingly low. The new Delta Units include:

Combination 4-Inch Jointer 8-Inch Circular Saw Motor Driven

A convenient, efficient combination. Permits sawing, sizing, and smoothing in one quick operation. Both Jointer and Circular Saw are run from the same motor with separate belts. Neither Unit interferes with other. Can be operated together or separately. Mounted on sturdy welded steel stand of convenient height. A rugged portable outfit at an attractive low price. Furnished with or without motor as desired.

4-Inch Jointer Unit

Consists of new Delta 4-inch Jointer mounted on separate welded steel stand. Produces smoothly finished work in surprisingly short time. Built to give years of satisfactory dependable service on production work. Incorporates numerous exclusive features such as Self-Aligning Fence with accurate graduations permitting fence to be set quickly at any angle from 0°-45°. Fool-proof guard; Automatically-oiled bronze bearings; Non-slipping V-belt drive. Furnished with or without motor.

8-Inch Circular Saw Unit

Consists of new Delta 8-inch circular saw on gracefully designed welded steel stand. Practical design and sturdy construction make it ideal for steady production work. Has Automatically-oiled bronze bearings; Patented tilting table; practical Miter-gage and Rip gage; Raising and Lowering Crank Screw permitting micrometer-like adjustment; V-belt drive. Furnished with or without motor.

Send coupon today for FREE Illustrated Literature showing many items of interest to those who work with wood.

Dept. A.129

Division of Delta Manufacturing Co.
1661-67 HOLTON ST. MILWAUKEE, WIS.



**4-Inch
Jointer
Unit**

**8-Inch
Circular
Saw Unit**

"DELTA"
Means Quality in
Every Detail

Delta Specialty Co., Dept. A.129
Division of "Delta Manufacturing Co."
1661-67 Holton St., Milwaukee, Wis.

Please send me without obligation, FREE illustrated literature showing new 1930 Delta line. Also full details of your 10 day trial offer and easy terms.

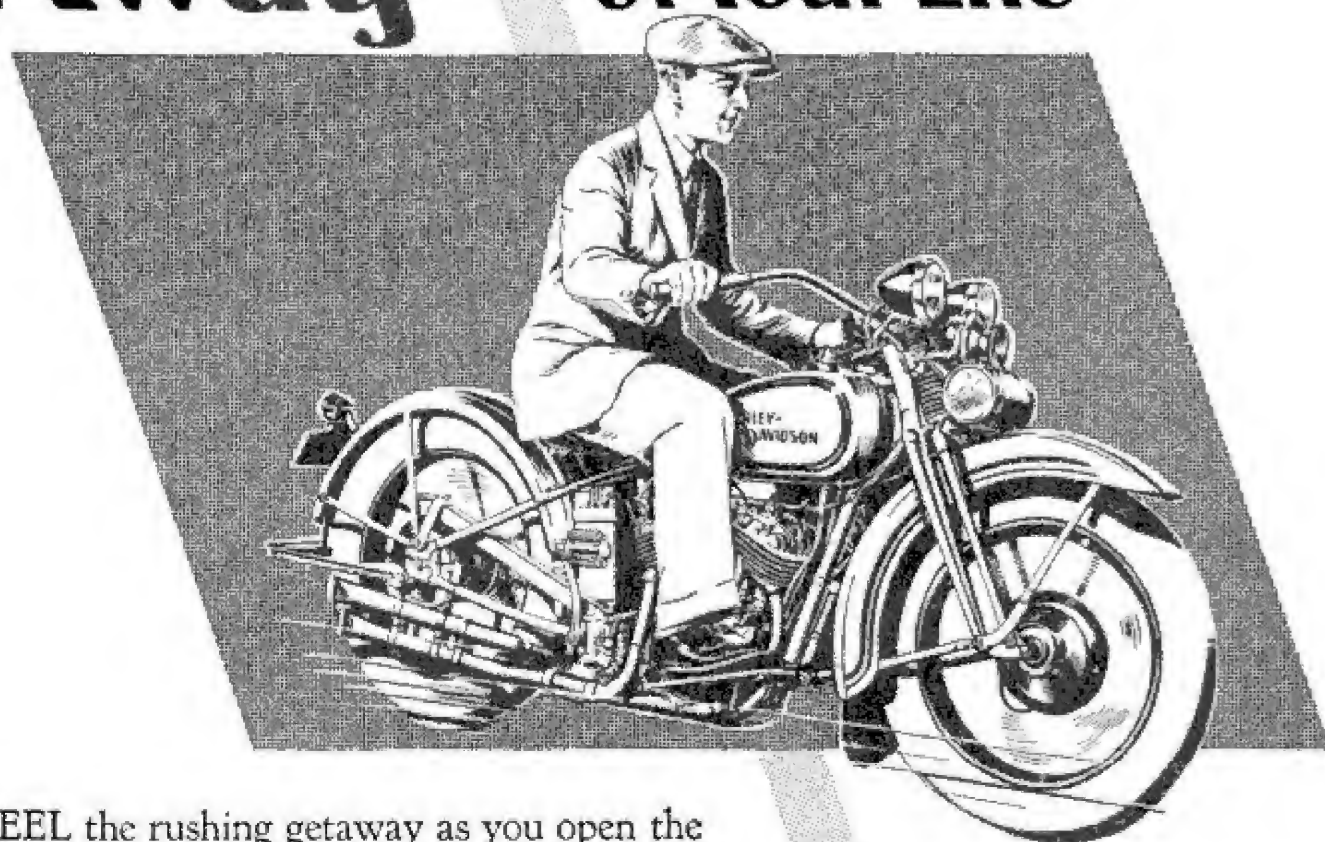
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☐ I am particularly interested in Delta Electric Handi-Shop.
☐ I am interested in new Delta Woodworking Units.

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Address.....

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"45 Twin" for 1930
— a very popular model. The ideal solo motorcycle.

FEEL the rushing getaway as you open the throttle — the quiet speed as you flash down the road — the eager power as you zoom over a hill!

That's motorcycling, on a Harley-Davidson 45 Twin — and no other sport has such a "kick". You will find new thrills every mile—whether you ride on long tours, short jaunts, or just to work and back. And the total cost is barely 2 cents per mile, including everything.

Let your nearest Harley-Davidson Dealer show you the 1930 models — look over their new features and improvements. Ask about his Pay-As-You-Ride Plan.

*Mail the
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Motorcycles

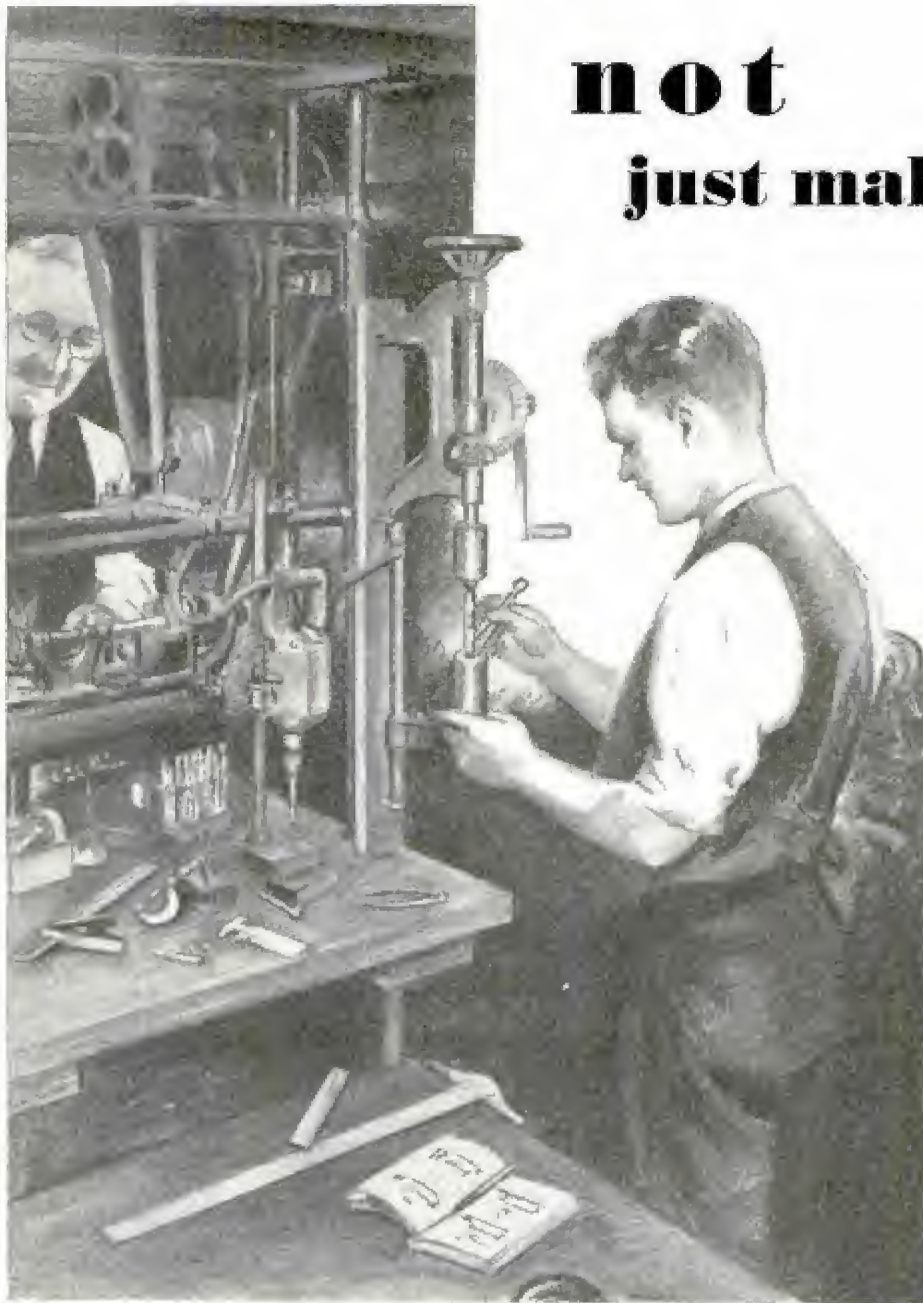
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—for literature showing our full line of Singles, Twins, and Sidecars. Prices range from \$235, f. o. b. factory.

HARLEY-DAVIDSON MOTOR CO. Dept. P., Milwaukee, Wis.
Interested in your motorcycles. Send literature.

Name.....
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My age is ☐ 12-15 years ☐ 16-19 years ☐ 20-30 years ☐ 31 years and up.
Check your age group.

not just making things ..



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NOT just making things, but making them right—that's the big kick you get out of your shop down cellar when you work with Starrett Tools.

Each of the Starrett Tools shown here—and many another besides—should be in your tool-chest. They are accurate, practical, dependable.

Write for Catalog No. 24 "AP" showing over 2500 Starrett Tools. Your dealer will be glad to show you the tools you select.

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*World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
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FROM THE CANADIAN BORDER TO LONG ISLAND
SOUND, PATROL CARS CARRY THIS UNFAILING
WINTER PROTECTION « « EVEREADY PRESTONE



READ what Major John A. Warner, Superintendent, has to say about the use of Eveready Prestone, the perfect anti-freeze, in the cars used by the New York State Troopers in the performance of their duties:

"We have had no single instance where complaint has been found with it. It has been employed under the most trying of weather conditions. Frequently our men are on the open roads for hours at a time, during which their cars must function under all sorts of stress and strain.

"It is gratifying to us that during the past two years Eveready Prestone has contributed so materially to the success with which the State Police have been able to carry on their work."

Wherever men, engaged in hazardous cold-weather duties, entrust their lives and reputations to motors, there you will find Eveready Prestone. At Army flying fields. At Navy air stations. With Commander Byrd in the Antarctic. And one supply of Eveready Prestone will provide your motor with the same complete, permanent protection against freezing. It possesses all the properties pointed out by the National Bureau of Standards as essential for an anti-freeze.

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Eveready Prestone does not contain any alcohol or glycerine.

9 POINTS OF SUPERIORITY

- 1 Gives complete protection.
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FOR PREPARATION OF THE
PERFECT ANTI-FREEZE

radiator will provide trouble-free surety against all freezing hazards through all kinds of weather. You can buy it at the nearest garage, filling station, automobile supply shop or hardware store.



Thoroughly tested and 100% approved by the American Automobile Association.

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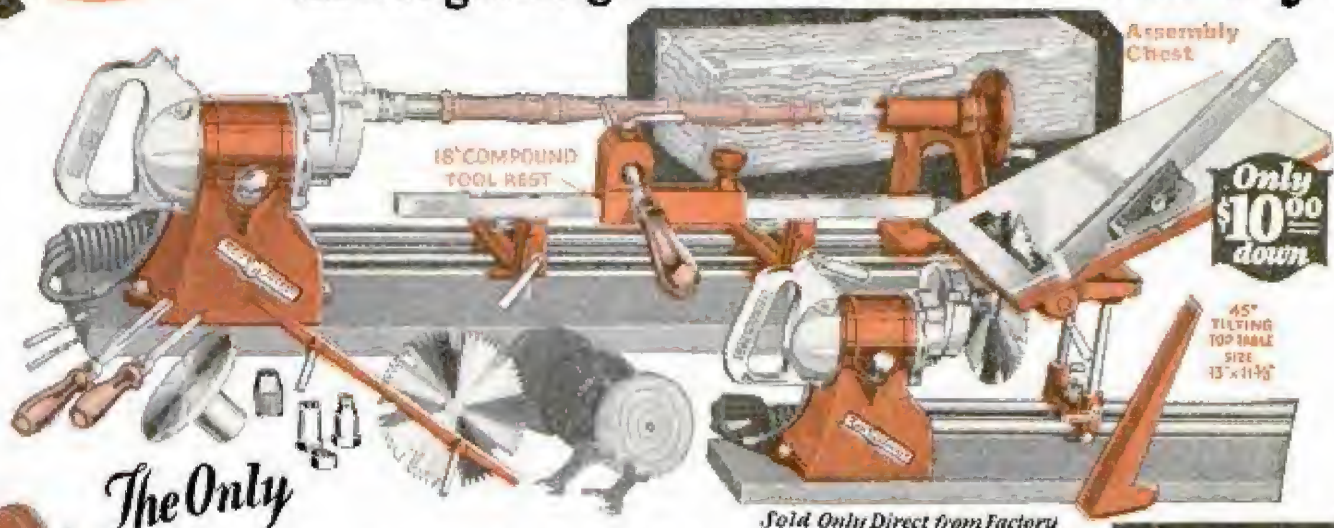
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Enjoy the thrill of your new skill in making things this modern motorized way!

The New 1930
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The Only

Complete Interchangeable Power Shop - Improved Features - Exclusive Advantages

Sold Only Direct from Factory

The right kind of tool-equipment is even more necessary than your own ability and desire. Now, you can do the things you long have wanted to—at home in your own modern motorized work shop—with this new, improved Waco Red Jacket Wonder-Shop. No other compares with it in its complete, interchangeable, power features, efficiency, exclusive advantages and quality.

Join the Happy Family of Waco Wonder-Shop Workers

Red Jacket Equipment is designed, tested, approved and guaranteed by Wm. L. Aylward, a nationally known craftsman and manufacturer who has developed his own life's hobby into a cooperative association of thousands of amateur and professional craftsmen. He invites you to join. He will instruct, guide and help you. A new zest in doing things awaits you.

The new 1930 Red Jacket Combination brings you the powerful Red Jacket Master Drill Motor with direct drive to the Waco Craftsman's Wood Turning Lathe (capacity 9" x 36"), Compound and 18" Rests, Tilting Top Mitre Saw with both depth and side gauges, Sander Desk, Scroll and Jig Saw, Improved Band Saw, and all accessories for both portable and stationary power drilling, buffing, grinding and cleaning. Attaches to light socket. Converts your work bench into a complete private tool and machine shop—a complete chest full of electrically driven tools for your own private use.

Add New Special Equipment Any Time as Desired

Take your choice of four different assemblies to fit your present ideas and uses. Any time you wish to expand or add new special equipment you can do so. The Waco Red Jacket Assortment is the most complete available anywhere. *Avoid Imitations!* Waco Red Jacket is the pioneer—foremost in the field—sold only direct from the factory; not through stores.

Professional Quality and Efficiency

The choice of professional as well as home craftsmen. Red Jacket Shops are making money for their owners all over the country. You can be one of the Red Jacket Guild chain and market your products if you want under our new plan.

Buy It NOW On Easy Terms

Only \$10 down. Easy monthly payments. Liberal discount for cash. No hardship to own a Waco Red Jacket. You can make it more than pay its way in profits if you want, as well as in the pleasure of doing things for yourself.

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Detailed descriptions and specifications. You will be surprised and fascinated by the possibilities afforded. Just see what you can make and do. Fill in and MAIL TODAY.

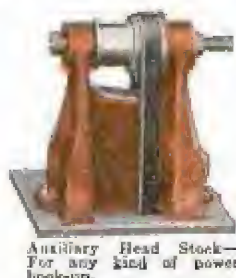
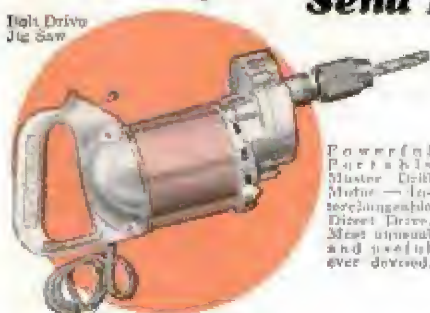
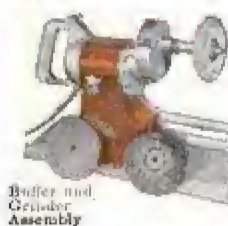
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Make Them Yourself!



Special Craft Course FREE

All there is to know about handicraft methods, raw materials, carving, turning, sawing, designing, etc., etc., is taught you by correspondence.

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The WACO GUARANTEE

If it is not what you want when you got it—send it back.



Gee, Dad! Couldn't We Have Fun with One of Those Chests!

A set of tools—what do they mean? To the boy—boats and airplanes and swords and heaps of shavings; to Dad—a workshop—hours of interesting recreation with his boy.

Boys or men, the fascination is the same. Why not a chest of Stanley Tools for them this Christmas? There are ten different sets all packed in sturdy chests. From \$10.85 to \$90, there is one to fit every purse.

There are also twenty-five Stanley Plans giving step by step instructions how to make twenty-five useful household articles. The book, "How to Work with Tools and Wood," is a practical textbook and guide for tool users.

Plans cost 10c each; book, \$1.00.

Your hardware dealer will be glad to show you these tool chests. Ask him for a copy of Stanley Tool Chest Catalog No. S35d or send to us for a copy.

THE STANLEY RULE AND LEVEL PLANT
NEW BRITAIN, CONN.



STANLEY TOOL CHESTS



Hello boys!
now you can build this
Giant Air Liner with

ERECTOR

HELLO, BOYS! The boy who gets my new TRAIL BLAZING No. 8 ERECTOR for Christmas will sure be the talk of the town. When you've built your 5-foot model of a real trans-atlantic Zeppelin, your pals will flock from miles around to look it over—with its giant silver bag, gondolas, propellers, landing mast. And that's not all. You can build almost every mechanical invention you can imagine.

Think what a thrill you'll get building these wonderful models that whiz and hum along when operated with your big powerful Erector electric motor. Airplanes, Automobiles, Trains, Steam Shovels, Locomotives, Derricks, Bridges, Power Plants, are only a few.

Now, boys, here's the way to get this barrelful of red blooded fun. Send for the amazing Mysterious Erectorscope and Catalogue that tell all about Erector. Show it to your Dad—then take him to any good toy store. Let him see Erector himself. It's a sure way to get the World's Greatest Toy for Christmas.

A.C. Gilbert

SUNDAY
AFTERNOONS

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**RADIO'S
ZIPPIEST
FEATURE**

A. C. Gilbert's Famous
Sports Talks

Let me introduce to you Babe Ruth and other great Sports Heroes of 1929! Hear them broadcast their inspiring messages to the boys of America. Every Sunday afternoon beginning November 10th. Remember the Time—5:30 Eastern Time, 4:30 Central Time, 3:30 Mountain Time, 2:30 Pacific Time. Cut out the list of stations below and choose the one you get best on your radio receiver.

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WEEI Boston
WJAR Providence
WTAG Worcester
WCEH Portland, Me.
WFI Philadelphia
WCAE Pittsburgh
WABC Washington, D. C.
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WSAI Cincinnati
KYW Chicago
WWJ Detroit
KSD St. Louis
WCCO Minneapolis, St. Paul
WABC Denver
WRO Des Moines
WOW Omaha
WDAF Kansas City
WTMJ Milwaukee
WERC Superior, Wis. & Duluth
KOA Denver
KSL Salt Lake City
KFI San Francisco
KOMO Seattle
KFI Los Angeles
KGW Portland, Ore.
KHQ Spokane

and other N. B. C. Chain
Radio Stations.



THE TRAIL BLAZING NO. 8. The Set That Builds the Zeppelin, \$25
The giant ship of the skies, and hundreds of other great inventions. Includes girders for Zeppelin frame and landing mast, silver bag, gondolas, propellers, stabilizers, and in addition includes all the parts of the Sensational No. 7½ Erector.

SENSATIONAL NO. 7½ Motorized Erector BUILDS the CHASSIS, \$15

Here's the set I know will give you the greatest thrill you ever had. Fun? Oh, Boy! It's the real thing. From this great assortment you can build over 500 models. Automobile Chassis, Tractors, Scooters, Fire Engines, and a Hook and Ladder are only a very few. Packed in a big, red, brass-bound chest: 15 inch steel truck body, steel model building tray, 28 page manual, powerful electric motor, completely assembled gear box, steel disc wheels, oversize balloon tires, fenders, radiator, hood, bumper, springs, steering wheel, heavy truck axles, cab top, steam boiler, steam shovel—in fact, 25 lbs. of scientific thrills for every day of the year.



Why the New 1929 ERECTOR is the world's greatest toy

1. **PATENTED ERECTOR GIRDER.** A real genuine girder like engineers use. The interlocking edge, a novel, exclusive ERECTOR feature, eliminates bending and makes it possible to connect two girders, sturdy and strong, with a single bolt and nut, and a four piece square girder with two screws only. (In all Erector Sets.)
2. **PATENTED ERECTOR MOTORS.** Powerful Battery Motor in No. 4, 6, 7, 7½ and 8. Famous Polar Cub 110-volt Universal Motor in No. 9 and 10.
3. **PATENTED ASSEMBLED GEAR BOX.** Adaptable to every possible gear combination, and for reversing movements. Convertible into 3-drum hoisting engine. Standardized for use with either battery or 110-volt Motor. Included assembled in the Famous No. 4 Set and up.
4. **HEAVY STEEL TRUCK BODY.** 15 inches long. Exclusive ERECTOR feature. In No. 7½ Set and up.
5. **3¼ INCH SOLID STEEL DISC WHEELS WITH BALLOON TIRES.** An exclusive ERECTOR feature. In No. 7½ and up.
6. **PATENTED BIG GIANT CHANNEL GIRDERS,** straight and curved. Electrically baked in brilliant red. Exclusive ERECTOR feature. In No. 7 and up.
7. **LARGE STEEL MODEL BUILDING TRAY,** pierced with ERECTOR standard holes. Patent pending. Exclusive ERECTOR feature. In No. 6 and up.

NEW ERECTOR ZEPPELIN FEATURES

Patented Erector Zeppelin girder, silver bag, gondolas, propellers, stabilizers, rudders, etc.

OTHER EXCLUSIVE SENSATIONAL FEATURES

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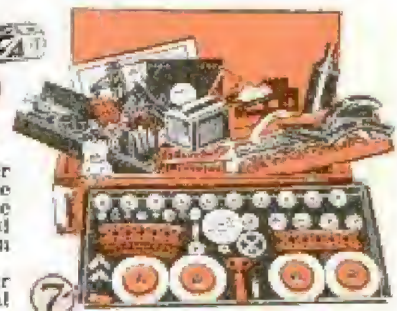
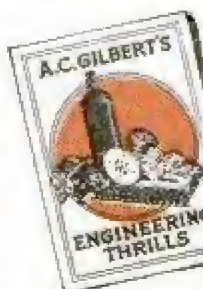
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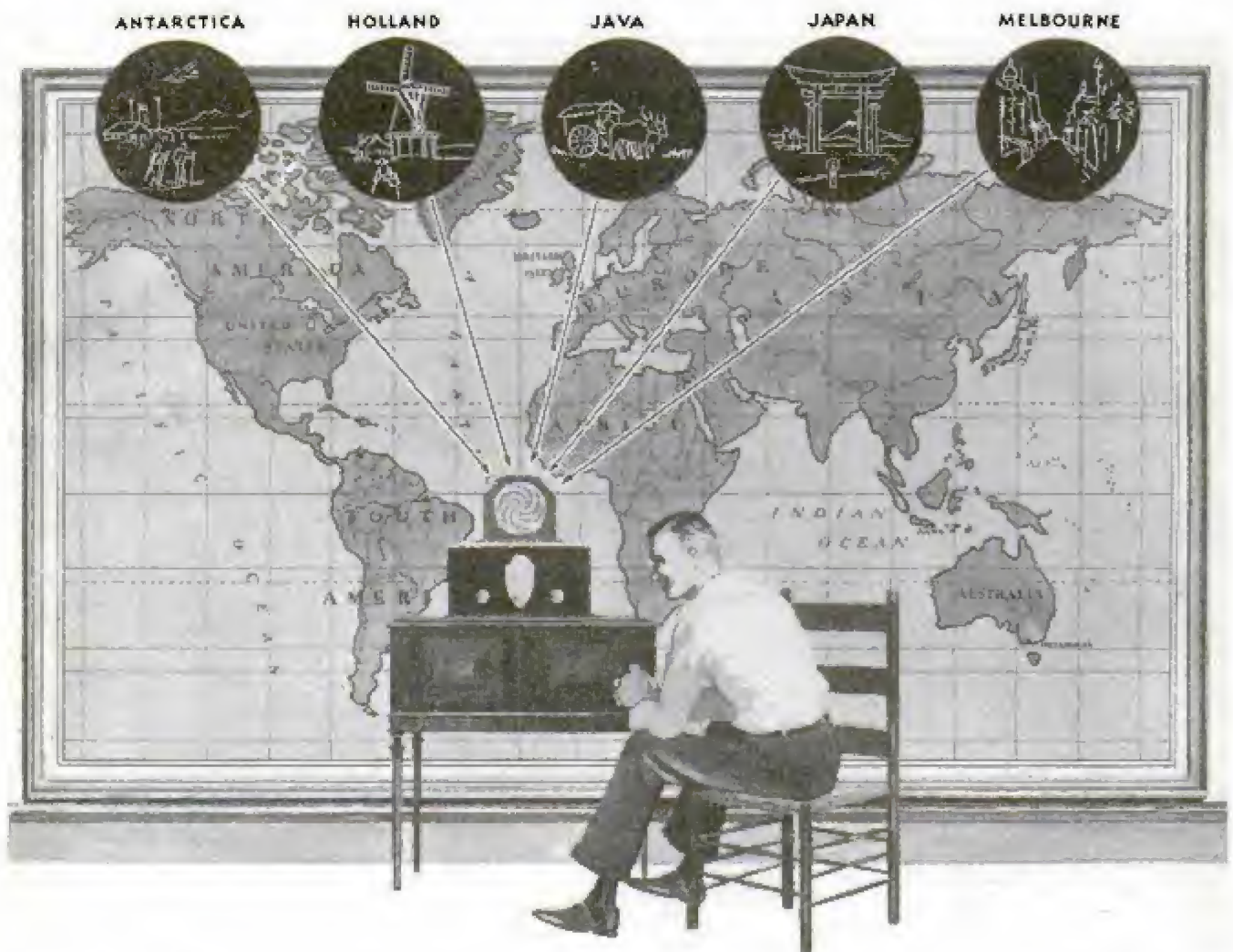
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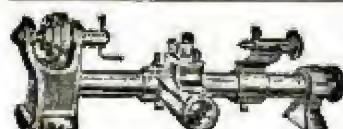


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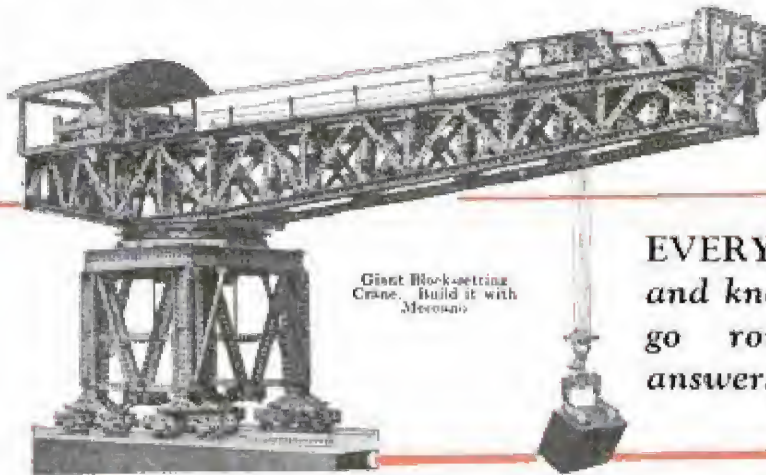
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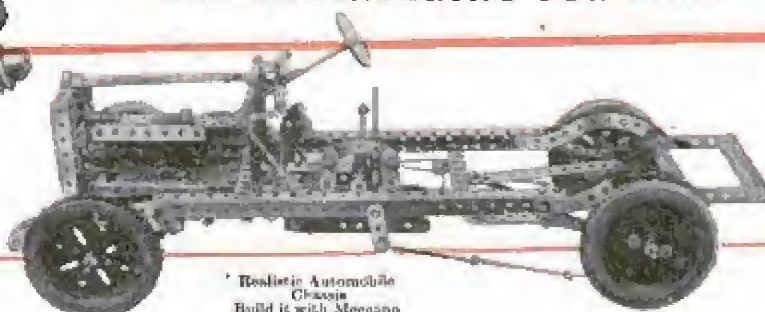


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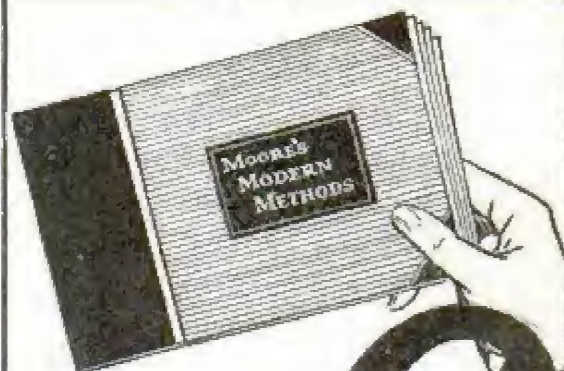
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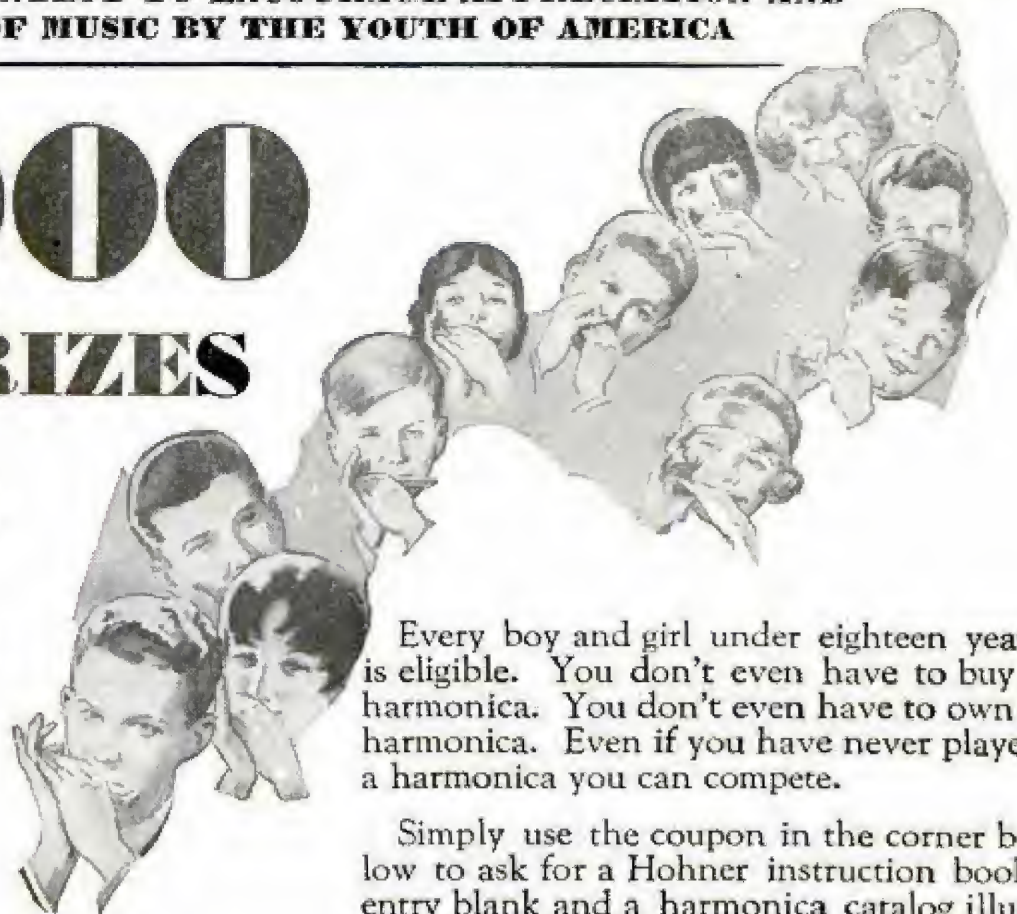
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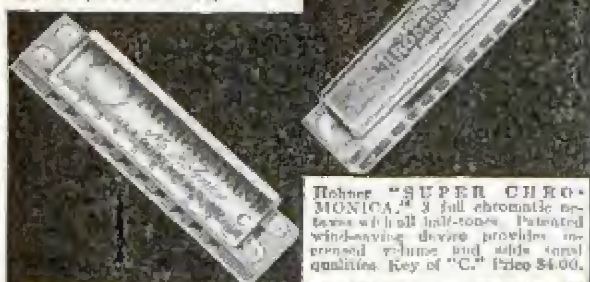
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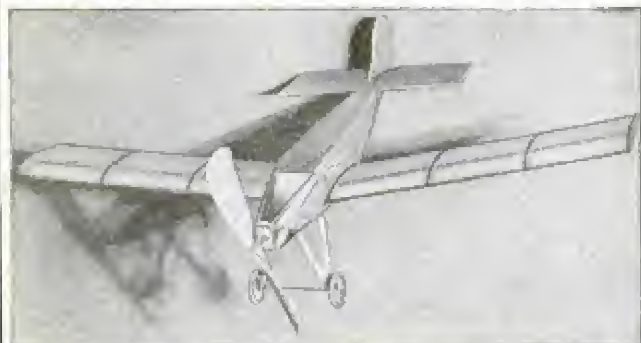
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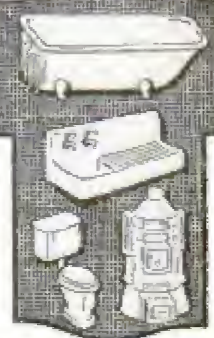
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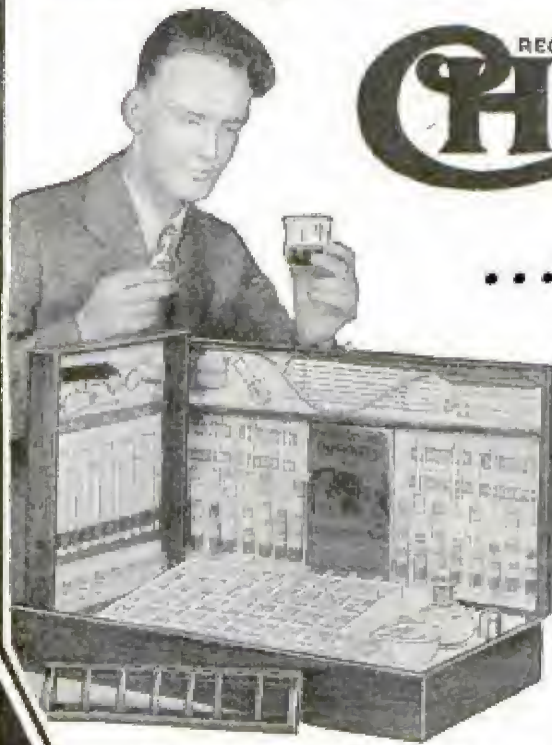
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INKOGRAPH CO., 161-77 Centre St., NEW YORK

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THAT BALL-LIKE 14 KT GOLD POINT

AGENTS Send for Inkograph or FREE sales plan booklet. Sells on sight, no investment, immediate commissions.

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Bodies for Ford and Chevrolet
\$18.75 and up
Hi-Compression Heads, underslung Parts, Racing Gears, Cowl Lamps, Roadlites, Seat covers, Also Boats, Canoes, Portable Radio, Bicycles, and Camping Outfits. Send 10c for Catalog showing bodies of rare beauty and complete equipment.

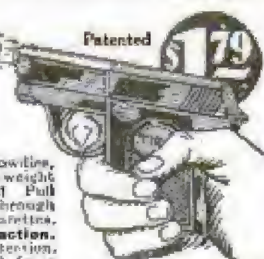
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Build a Real Auto from Used Chassis
AURORA, ILL.

DOUBLE ACTION AUTOMATIC Pull the Trigger— Out Pops a Cigarette

Protect yourself against hold-up, rowdies, etc., with this clever cigarette case of light weight metal. Looks like genuine automatic! Pull the trigger and out pops a cigarette through the muzzle. Holds nearly a full pack of cigarettes. Handsome gun metal finish. Double action. Lots of fun for friends and a great protection. Order one to-day. When your friends ask for a cigarette, shoot one to them and enjoy a big laugh. Either enclose money order for \$1.79 or pay postman \$1.79, plus postage on arrival. Money back if not satisfied. **PATHFINDER CO., Dept. B12, 200 Hudson St., New York**



You Can't Beat This for Value!

Here's Boice's newest workshop—the 5-machine Handi-Bench, complete from floor to switch! Designed for industrial or home use. Each machine complete in itself and ready to run.

Boice's Handi-Bench No. 5

As illustrated below, consists of following equipment:
12" Handi-Band Saw, 7"x40" Handi-Lathe, 4" Handi-Jointer, Universal Jig Saw, Universal Handi-Saw, 2 Motors, double shaft, ½ h. p. each, 3"x8" Bench with legs.
Price complete..... **\$205.00**

Boice's Handi-Bench No. 3

Not illustrated. Universal Handi-Saw, 7"x40" Handi-Lathe, Jig Saw, one ½ h. p. double shaft motor and 3"x8" bench with legs.
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Note: Any one or more machines in these Handi-Bench outfits may be bought separately at any time.

Send 10c for \$80-page catalog describing these Handi-Benches and other Boice-Crane machines. Ask about our Easy Pay Plan.

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You needn't send us a cent! America's big, old, reliable Radio Factory springs its 10th Anniversary Surprise in high-grade full-year guaranteed sets at history's lowest prices! With its latest perfected Screen-Grid, push-pull, super-powered and hum-free AC electric Miraco's—you are guaranteed satisfaction, values and savings unsurpassed.

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With Miraco's rich, clear cathedral tone, quiet operation, razor-sharp separation

of nearby stations, tremendous "kick" on distant stations and latest improvements—you'll be the envy of many who pay 2 or 3 times as much!

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Dealers Write! - mail coupon right Now!



BEAUTIFULLY ILLUSTRATED LITERATURE

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Amazing Special Factory Offer

MIDWEST RADIO CORPORATION
10th Successful Year

407-ED Miraco Bldg., Cincinnati, Ohio

WITHOUT OBLIGATION send latest literature, AMAZING SPECIAL FREE TRIAL OFFER, testimony of nearby users, etc.

☐ User ☐ Agent ☐ Dealer
☐ Check here if interested in an EXCLUSIVE TERRITORY PROPOSITION.

Name
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**User Agents Wanted!
Exclusive Territory**

**DEMONSTRATOR SENT
GET OUR PROPOSITION**

Excels \$425 Outfit

My 30 days trial on my Miraco AC-9 is up and if you would offer me \$200 extra for it back, I would tell you nothing doing. We had some very expensive sets in our home, one a \$425 9-tube AC set. Thanks to you I have a set that gets any and all stations. I have got stations in 45 states, also Cuba and Canada. It is beyond words to tell you what we think of our wonderful bargain. I will always praise Miraco's to everyone. J. W. LAUDERBACK, Barberton, Ohio.

Coupon brings proof like this from people in YOUR locality, too.

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\$39.85**

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Tells how to hold, aim and handle rifles; helps you guide others in correct knowledge of guns. Gives facts that make crack shots. Contains safety and common sense instructions every parent and boy should have. Helps to make boys leaders. Your copy free. Write at once.

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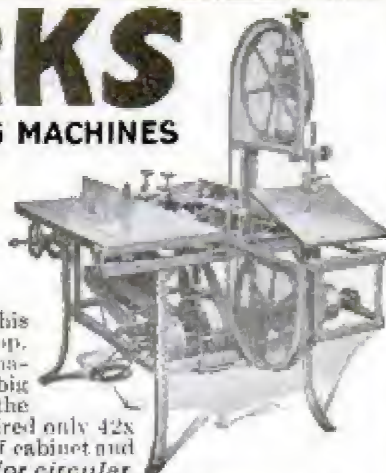
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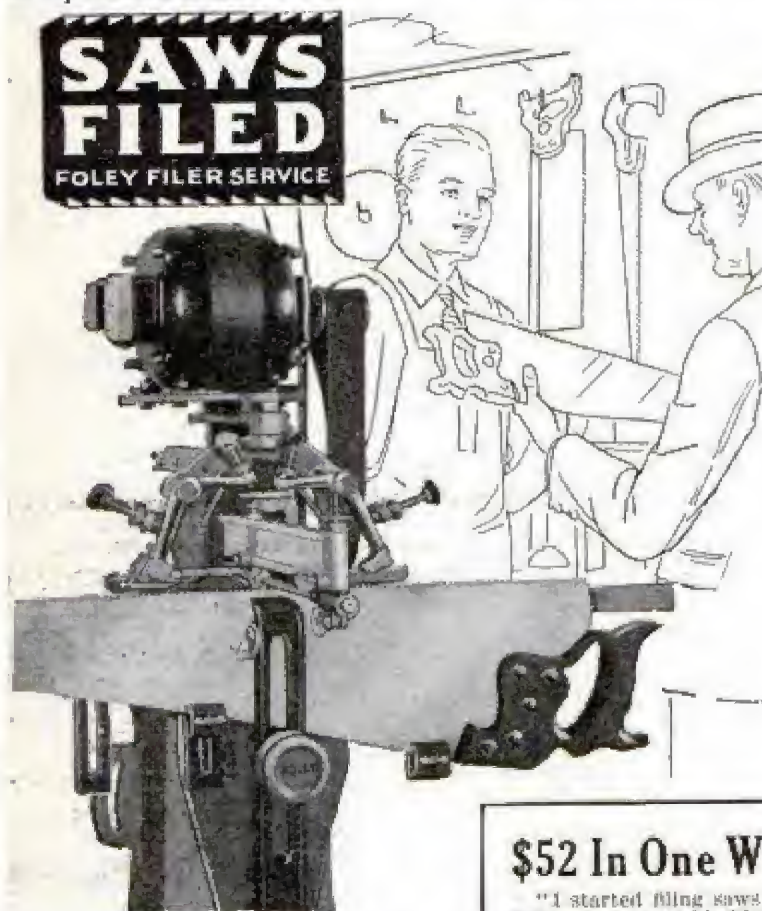
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Young Man! Here Is Your Opportunity to Make BIG MONEY

START in business for yourself now! You can do it with the Foley Automatic Saw Filer. Nothing else like it in the world. Files hand, band and circular saws **automatically** with such mechanical accuracy that they cut faster, and stay sharp longer. Better than the most expert hand-filing. **Easy work** to file 5 and 6 hand saws an hour. **No experience necessary**—even boys of 14 are operating the Foley Filer. Simply adjust the saw in the machine and snap on the switch. You don't have to be a skilled mechanic to do it—very simple to operate. With a little practice you can turn out **perfect cutting saws** that will please your customers and bring you plenty of repeat business.



Start At Home In Spare Time

Make \$2 to \$4 an hour in spare time while starting. No high-rent store necessary, very little capital needed. You can start in your garage, basement, attic, or anywhere. Soon you will have plenty of business to keep you busy full time. J. J. Southwick writes, "Enclosed find contract for my second Foley Filer. The first machine easily paid its own way and increased business, and I am expecting this to do the same." Frank Huber says, "It is very easy to pick up enough work to pay for the machine in a short time."

No Canvassing

You can get all the business you can handle from carpenters, contractors, schools, factories, hardware stores, and others. William G. Diederick writes,

"I am kept busy filing saws. To tell the truth, I get more saws than I can handle."

Thomas Hoadley has filed between 25,000 and 30,000 saws during the last two years with his two machines.

Get Started Now!

Lots of men, old and young, are making **big money** filing saws on the Foley. They have a fine paying, steady year-'round cash business of their own. Many started in their spare time. Our **Free Plan** shows you how to get started. Others are making **big profits** from the Foley Filer—get in the game! Be your own boss—don't delay—mail coupon **NOW!**

\$52 In One Week

"I started filing saws on the Foley as a sort of hobby in my spare time. I got my first machine and in five months had to buy another. Have filed \$52 worth in one week and am absolutely satisfied. Instead of a playtime hobby it has gotten to be a regular business."

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Foley Manufacturing Co.
246 Foley Bldg., 11 Main St. N. E.
MINNEAPOLIS, MINNESOTA

Foley Manufacturing Co.

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Minneapolis, Minnesota

Please send me **Free Plan** telling me how I can start my own business in spare time and make **big money** with the Foley.

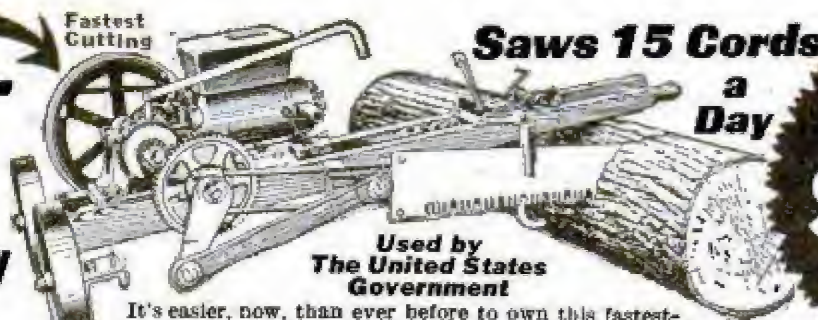
Name

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Mail Coupon for FREE PLAN

NOW — GET MY GREATEST Log Saw Offer



**Saws 15 Cords
a Day**

**ONLY
\$39**

Used by
The United States
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It's easier, now, than ever before to own this fastest-cutting, easiest-moved, most powerful Log Saw. Now you can make big money sawing firewood, stave-bolts, ice, shingle timber, etc. **WRITE TODAY FOR FULL DETAILS.**

**Try 30
Days**

OTTAWA

Make Big Money — Wood selling at \$3 a cord brings owner \$45.00 a day. Go into the wood business. Don't let the lack of ready money stop you. Remember, we sell on very easy terms. **To Save You Freight** — and get your machine to you a few days after you order, ship from factory or nearest to you of FOUR BRANCH HOUSES.

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FREE

Send me your name and address on a postcard today for my wonderful new edition of the "Wood Sawing Encyclopedia." Be sure to investigate—it will help you to make big money.

C. E. WARNER, Pres.,

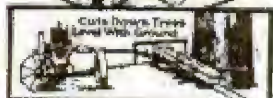
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**Puts the OTTAWA
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350 Cuts a Minute!

Take any size log — in a few seconds it's all sawed up — without any hard work!

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Anyone can trim or bob hair, shorten bangs, clip neck or underarms in a shape almost impossible with hand clippers or shears. Operates on direct and alternating current. Will not clog or cut the skin, and cuts as cleanly as a razor. Thousands in use. Rigidly guaranteed.

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If your hardware or electrical dealer can't supply you, write for interesting booklet, or order from this ad. Send no money — pay postman \$3.75. Return it in ten days if not satisfactory. State whether 110, 220 or 32 volt current is used.

Dealers and Representatives Wanted

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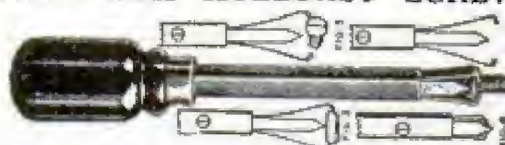
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Socket**

A red handle with a gold stripe marks the most popular blow-torches in the world. They are Clayton & Lambert blow-torches.

CLAYTON & LAMBERT MFG. CO.,
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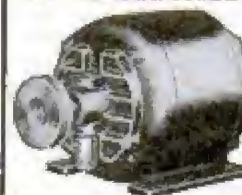
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Sells on sight to mechanics for Auto, Radio and Electrical Work. Self Holding, Self Releasing.

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Portable and heavy, 16 types and sizes. This No. 14 Portable is well built, highly efficient, and exceptionally convenient for light work. Tilting top; table raises and lowers, etc. 30 other Crescent working machines include band saws, self feed rip saw, shapers, jointers, planers and matchers, variety woodworker, disk grinder, cut-off table, swing cut-off saws, borms, hollow chisel mortisers, tenoners, universal woodworkers, universal variety saw.

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It's a brute for work. Drills in metal or wood. Lots of power. Will operate grinding and polishing wheels, wire brushes, sanders, buffers, etc. Westinghouse Motor. Full ball bearing spindle. Long life. A mighty good drill to have around. None better is made. Rated 1/4-inch general drilling in steel, overall length 11 3/4 in., weight 4 1/2 lbs. Price only \$24.00.

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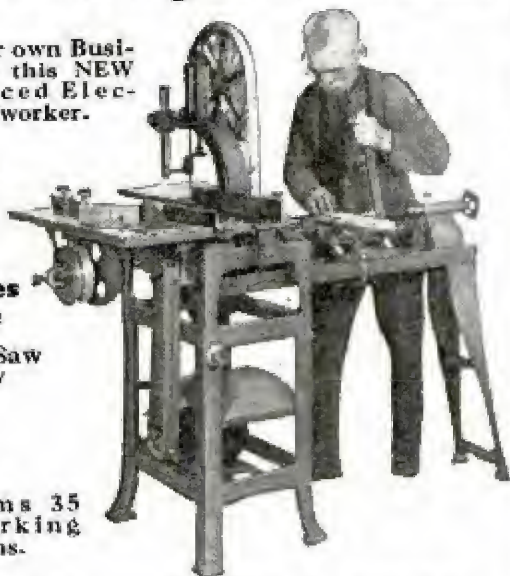
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Performs 35
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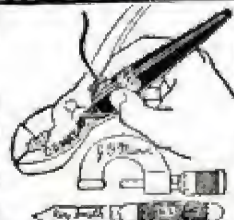
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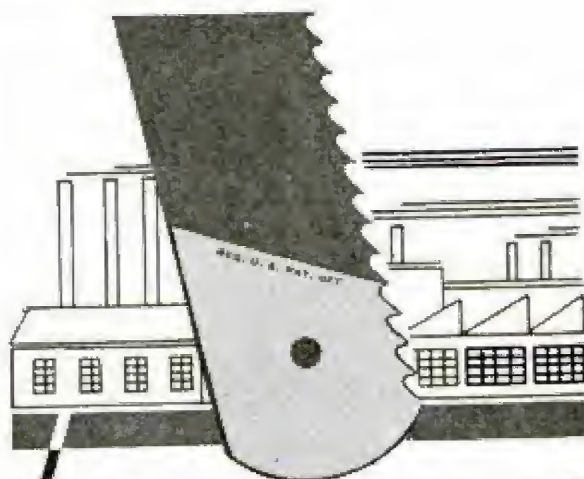
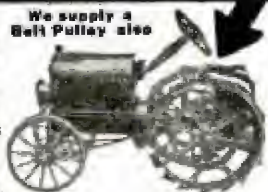
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Let "Red Streak" Hack Saws prove they out-perform any blade you've ever used.

WHEN you have a metal cutting job, you want it done as quickly and as easily as possible . . . you want the easiest and fastest cutting hack saw on the market.

You want "Red Streak" Hack Saw Blades! Mechanics in all types of trades praise the improved cutting qualities in "Red Streak" Blades. Electric furnace steel makes "Red Streaks" wear-resisting. Evenly set teeth make the cut go straight. They're made for those who handle a hack saw roughly.

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cut like lightning!

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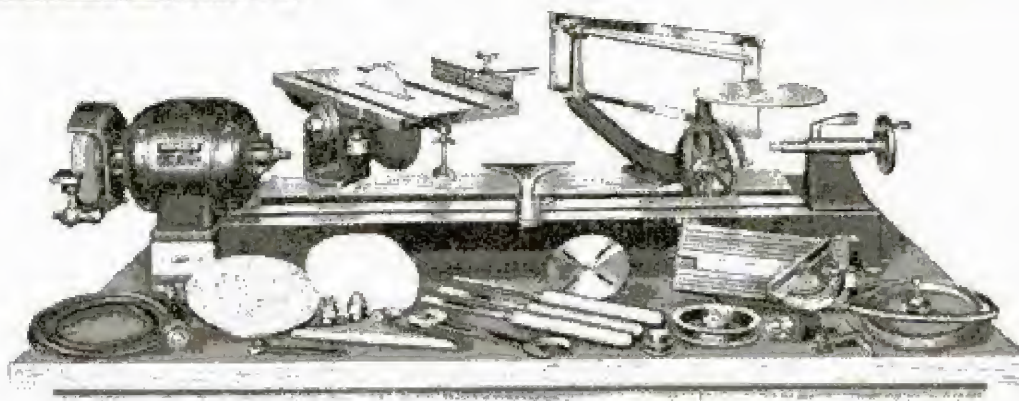
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A WORKSHOP that won't do all that you want it to do is, after all, only an expensive plaything. Make sure before you buy that the outfit you choose has the power to handle any load within its capacity; and the rigidity, strength and precision construction essential to fast and accurate workmanship. Then your choice unquestionably will be the Ar-Con Utilitool—the workshop that means satisfaction with every job you do.

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Mail me complete information, prices and terms on Ar-Con Utilitool with details of your free trial offer.

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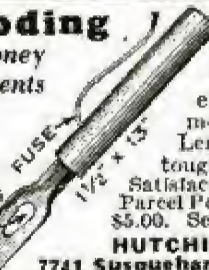
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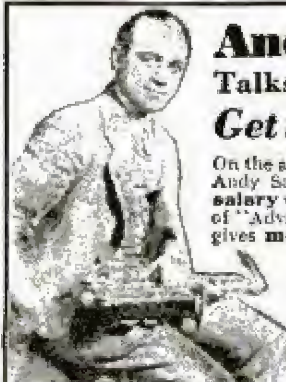
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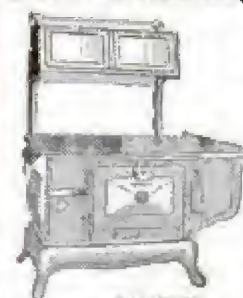
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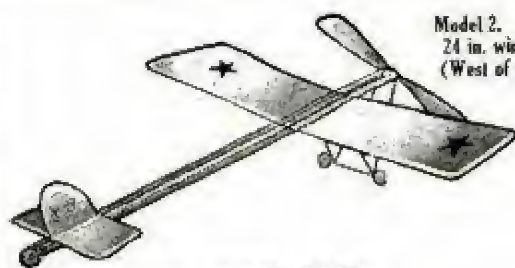
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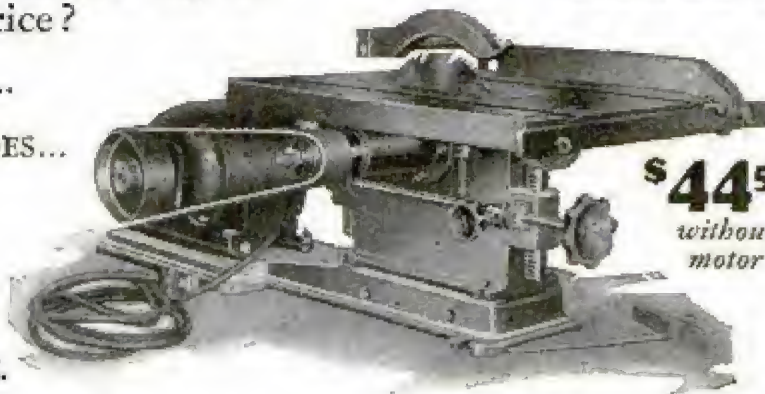
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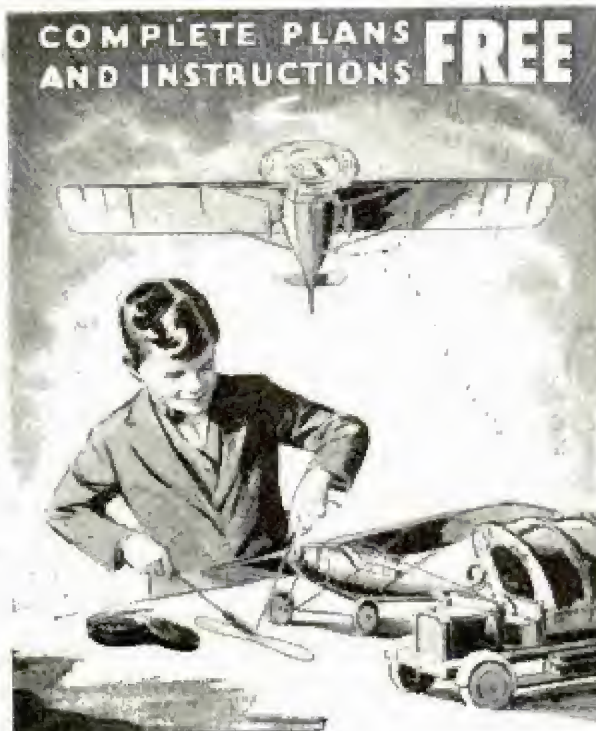
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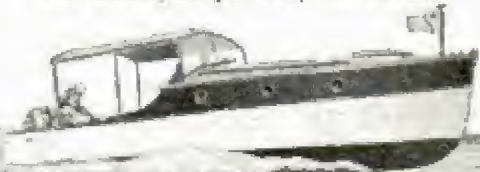
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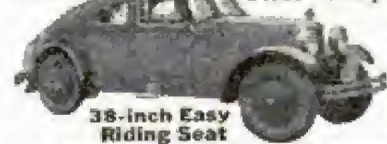
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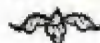
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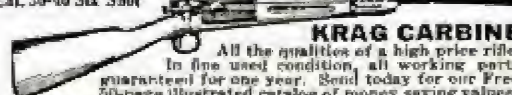
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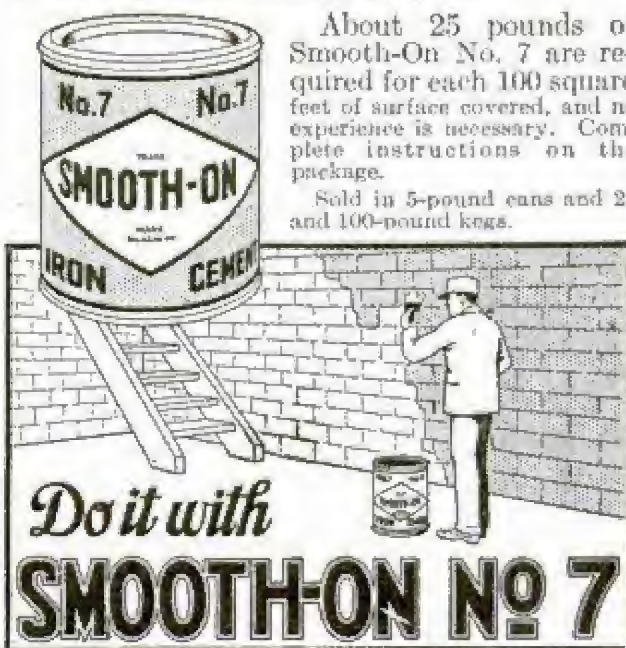
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These sets and cabinets are big surplus stocks of leading manufacturers' latest approved models. We bought them at tremendous discounts which enable us to give them to you at less than original factory prices. They are decidedly not seconds. Every Roosevelt is a perfect instrument of the highest grade—the only totally enclosed Screen Grid Chassis made, with all the newest improvements, exactly as shown. Under our liberal plan, merely to own one of these Radios qualifies you to act as an Owner-Dealer. You can buy your own set at the Owner-Dealer price. Enjoy it in your own home! Show it to your friends with our advertising. Then sell for one-half Regular Retail Prices and make 50% profit.

FREE Send for amazing offer giving full details and specifications. Clip, fill out, mail now for Owner-Dealer Offer.

MERCHANDISE CLEARING HOUSE CORPORATION
Dept. 509, 1737 S. Michigan Ave., Chicago

Roosevelt Model 94

A De Luxe console cabinet of genuine matched walnut with burl overlay and carved pilasters. True screen grid receiver and tubes; push-pull amplification, shielded reception; balanced condenser; three tuned stages; 7 tubes, including rectifier; all-electric; Utah Dynamic Speaker.



Model 94
Regular Retail Price... \$243.00
Special Sale Price... \$133.00
Owner-Dealer Price... **\$79.50**

Complete with tubes for this Xmas offer.

The Roosevelt Screen Grid Chassis



the only one totally enclosed.

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My new Model 25 Nose Shaper is designed to improve the shape of the nose by remoulding the cartilage and fleshy parts, safely and painlessly. This is accomplished thru the very fine and precise adjustments which only my patented Model 25 possesses. Results are lasting. Can be worn at night, or during the day. Money refunded if not satisfied after thirty days' trial. Write for free booklet to

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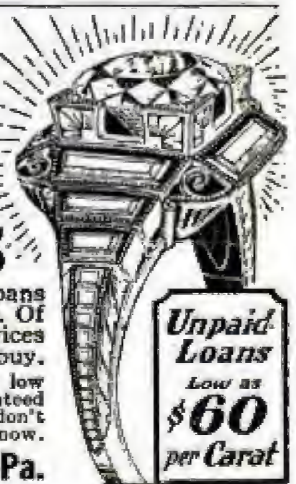
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10 large loan firms combined (world's oldest, largest association of its kind—rated over \$1,000,000.00), loans money on diamonds. A few such loans not repaid. Diamonds originally sold by outstanding jewelers. Of course we can loan but a fraction of real values. You get the advantage in Unpaid Loans at cash prices you can try to match at full 60% more. Every liberal privilege.—Examination free—No obligation to buy.

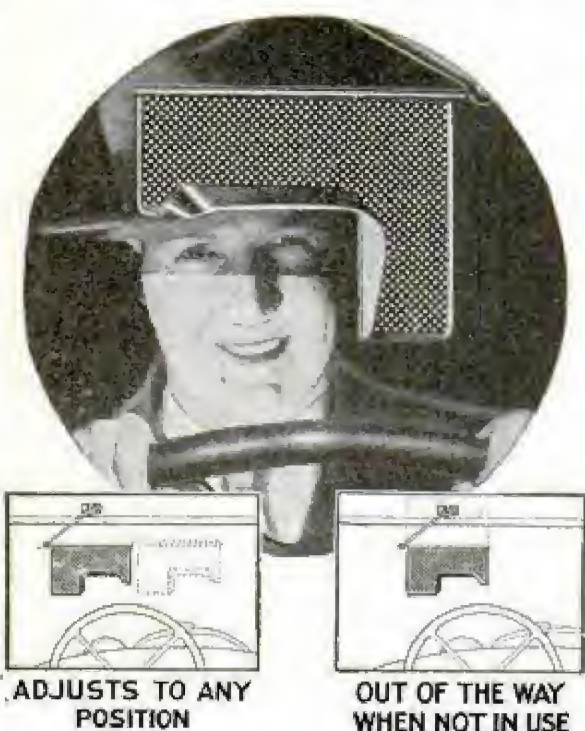
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Low as
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Now—end that nervous tension and peril that faces you when glaring headlights flash in your eyes on dark, narrow roads or winding curves. Face-a-Lite is more than a glare shield. Note description above.

\$33 Profit In One Hour

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FACE-A-LITE MFG. CO.
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Without obligating me, send free book,
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full description of Face-a-Lite and your
liberal introductory offer.



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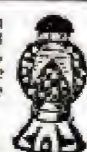
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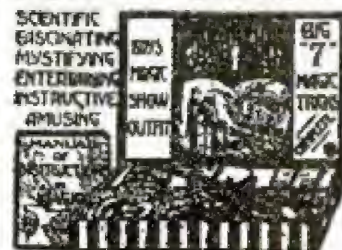


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MAGIC CARD BOX



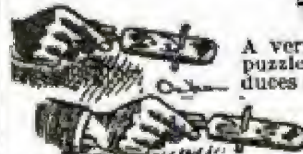
This mysterious box is useful in performing many card tricks. You ask two persons to each select a card from any ordinary pack of cards. One of the cards is now placed in this box and a second later when the box is opened the card has mysteriously disappeared. The other card is now placed in the box and when it is again opened the first card appears and the other one is gone. You can make several cards disappear and at command they all appear at once. You can tear a card up and place it in the box and when you open the box again it will be found whole. All easy to perform after reading our simple directions. Price 25 cents. Better grade, made of highly finished wood, \$1.25.



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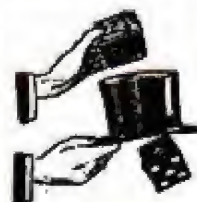
THE JUMPING PEG



A very effective pocket trick which will puzzle them all. The performer introduces a small wooden paddle into which a number of holes are bored. A wooden peg is then inserted in the upper hole, both sides of the paddle being shown, proving the peg enters on each side. Upon the performer simply waving his hand, the peg mysteriously jumps from the upper hole to the middle hole, then to the lower one and back again while both sides of the paddle are continually shown. Price 15 cents.

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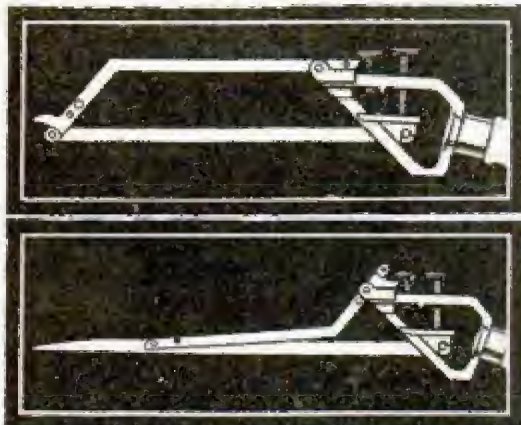
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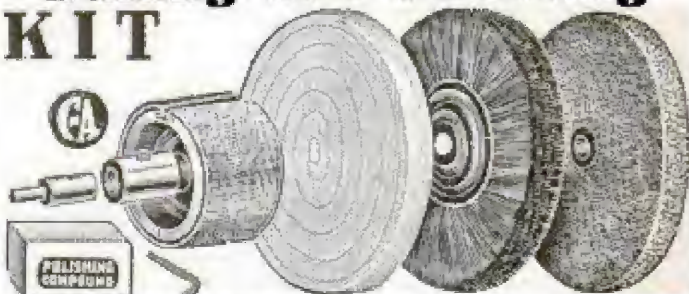
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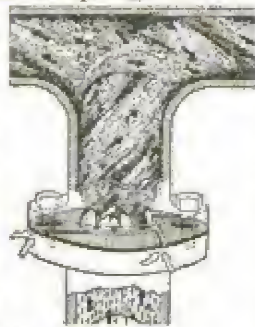
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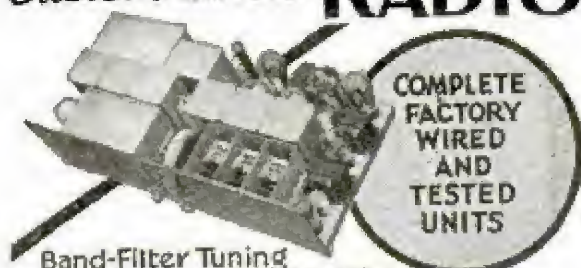
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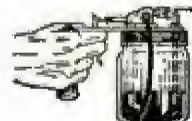


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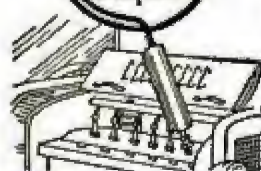
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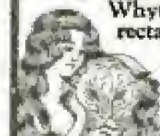
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The new No. 77 S. & B. Junior 7-inch Combi-
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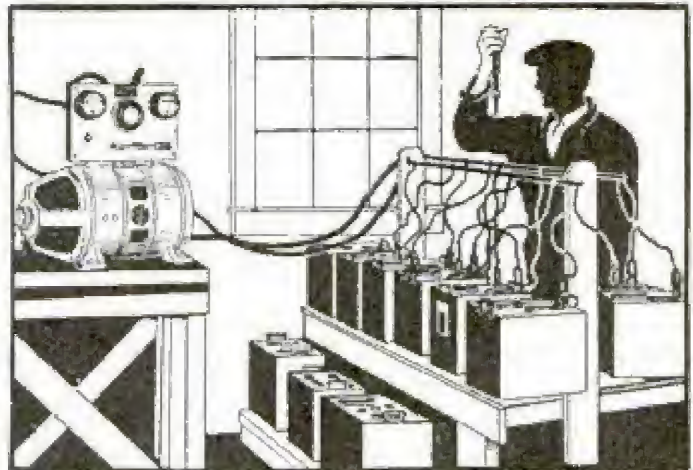
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This tool was featured editorially on Page 191, August, 1929, Popular Mechanics.

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Combined with
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Special without tubes



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This famous genuine Kolster K-5, AC Electro-Dynamic Reproducer is complete with a 210 Power Amplifier and "B" Supply Unit all self-contained on a steel frame. This real fine matched rugged Unit weighs 45 lbs. without the Cabinet. The Cabinet itself is Pencil-Striped Walnut, beautifully designed with Cathedral grille.

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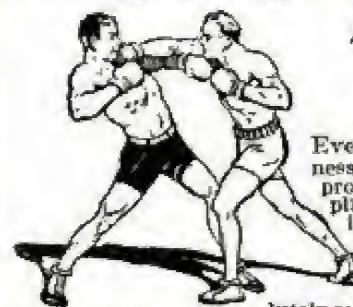
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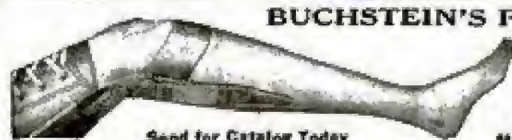


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This ad tells you the low-down about Clarke FlorKraftsmanship. There is no applesauce about Clarke's statements of what you can make. \$25 to \$75 a day is the pay men get for turning old floors into new ones and for sanding floors in new houses with the Clarke Vacuum Portable Sander.

A. E. Sweeney, Alturas, Calif., writes: "I made \$76 the first week." Fred S. Gail, Cody, Wyo., says: "The little Devil, as it is called around here, paid for itself on the first job." Millard W. Dalby, San Marcos, Calif., writes: "In one hour I had my 200 sq. ft. of that floor as clean and new as any new lumber would have been. My price for that work is 10c a foot." W. G. Roe, Clarke FlorKraftsman, Richmond Hill, L. I., N. Y., "I have made from \$40.00 to \$45.00 per eight hours with my Clarke."

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This is not a school course or training system. You pay no tuition—buy no books. We teach you to run the Clarke Vacuum Portable Sander in a half hour or less. You get paid for the first day's work you do with it.

You don't need to be a carpenter or a painter to get into FlorKraftsmanship. Clerks who never made over \$30.00 a week, mechanics who couldn't earn enough at their old jobs, young fellows just out of school, are highly paid FlorKraftsmen today.

The same opportunity is open to you. You need only about \$100 to start. No office or shop required. The Clarke and some sandpaper puts you in FlorKraftsmanship.

The Clarke sands 900 to 2200 square feet of new floors a day—and you get paid 2½c to 5c a foot. On old floors the Clarke does 300 to 1000 square feet every eight hours. Here you get 7c to 15c a square foot. Many operators do far more footage than this. No wonder FlorKraftsmen own cars and homes and still save for a rainy day.

Stop Wishing and Start Earning

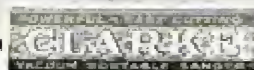
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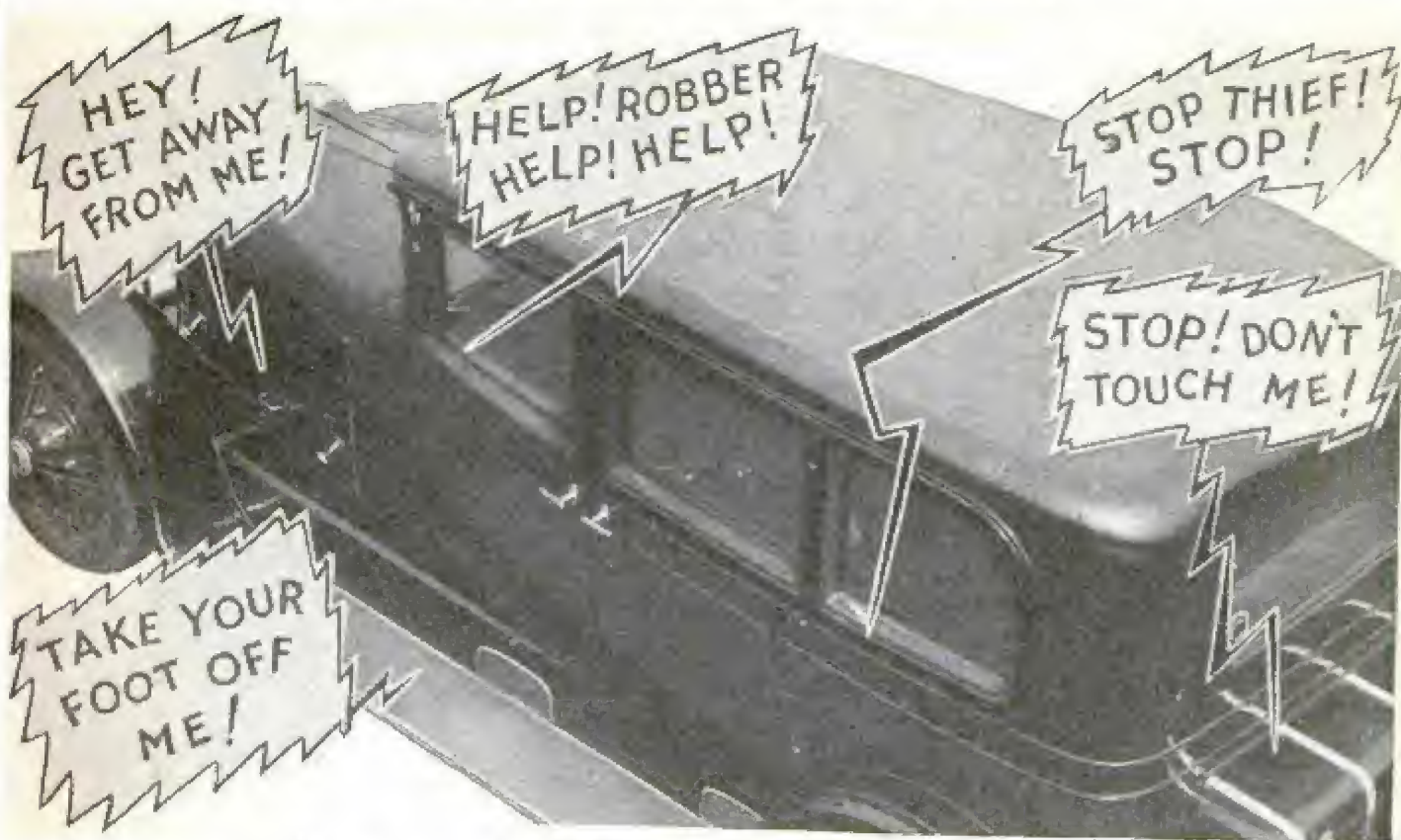
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DEVIL DOG**

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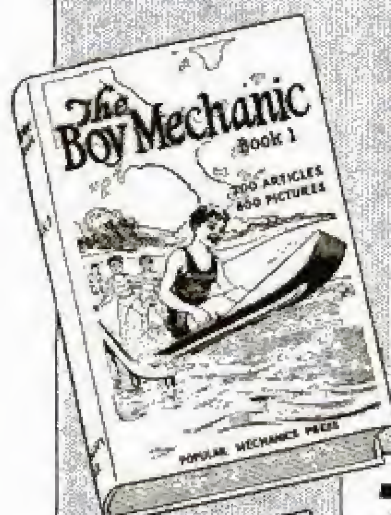
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The 600-page book which we mail entirely free of charge has a lithographed paper cover. But there are many of our friends who want this book in a permanent binding for their library shelves. For them we have prepared the De Luxe Edition of our catalog—a beautiful hard cloth binding—nearly 100 more pages—many pages in color—and the book itself is printed on very high grade paper. This De Luxe Edition will be mailed you postpaid for 25 cents. This price is, of course, but a fraction of the cost of this beautiful book. Check coupon and enclose 25 cents if you want the De Luxe Edition.

JOHNSON SMITH & CO.
Dept. 845 Racine, Wisconsin



LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world, Luminous Paint, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. **THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES.** Quite simple to use. Anyone can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons of switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Small bottle, price 25c. Larger sizes, 50c and \$1 postpaid. **JOHNSON SMITH & CO., Dept. 845 RACINE, WIS.**



CIGARETTE MAKER

Roll your own and save money. Better and quicker; saves more than half. Use your favorite brand of tobacco. Neat, useful, handy. Pocket size, weighs 1/2 oz. Made entirely of metal, nickel plated. 25c, 3 for 75c postpaid anywhere.



GOOD LUCK RING

Very striking, quaint and uncommon. Silver finish; skull and crossbones design; two brilliant, flashing gems sparkle out of the eyes. Said to bring good luck. Only 25c post.



Exploding Cigarettes

JUST LIKE ORDINARY CIGARETTES, BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud BANG! A great mischief provoker yet entirely harmless. Price 25c box.

NOVELTY BADGES



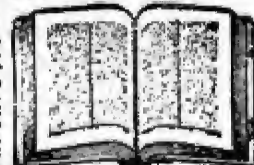
Kissing Friend 10c. Two very novel metal badges, nickel plated, that you can wear, giving you fun out of all proportion to their trifling cost. 10c, each badge, 3 for 25c, or 75c per doz. postpaid anywhere.

Garter Inspector 10c.

MIDGET BIBLE

GREAT CURIOSITY

Smallest Bible in the World. Size of a postage stamp. 200 Pages. Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. **PRICE 15c each, 3 for 40c, 12 for \$1.25, 100 for \$7.50.** Also obtainable in leather binding, with gold edges. **Price 50c each, 3 for \$1.25, \$4.50 per doz.** Magnifying Glass for use with Midget Bible 15c.



STAGE MONEY



With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. **Prices, postpaid: 40 Bills 20c, 120 for 50c, or \$3.50 thousand postpaid.**

MAGIC NOSE FLUTE



Post Paid 10c

The Magic Nose Flute, or Rhinoceros, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice, will enable you to produce very sweet music, that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument, the effect is as charming as it is surprising.

NEW BOOK ON ROPE SPLICING!

Useful Knots, Hitches, Splices, etc. How different knots are made and what they are used for, knots that are unsafe, etc. Over 100 illustrations. About wire rope attachments, lashing, blocks, tackle, etc. **PRICE 20 CENTS OR THREE COPIES FOR 50 CENTS POSTPAID.**

Address orders for all goods on this and following pages to
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Postage Stamps accepted

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Protection against Burglars, Tramps, & Dogs

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1 Blank Cartridge Pistol
100 Blank Cartridges
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The Lot Shipped by Express Only Cash With Order Only

Well made and effective, modeled on latest type of Revolver; appearance almost is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridge—obtainable everywhere. **Special cash with order offer: 1 Superior quality Blank Cartridge Pistol, 100 Blank Cartridges, and our new 55c De Luxe Catalog of latest novelties; all for ONLY \$1.50.** Shipped by Express only. Cannot go by parcel post. Extra Blank Cartridges 50c per 100. Special Holster (Cowboy Type) for pistol 50c. No C.O.D. shipments.



LOOK 35c LOOK Wonderful instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, Curious and Interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail. **Only 35c or 3 for \$1.00**

SURPRISE MATCHES

More fun than fighting with your wife. Look just like ordinary matches. Put up in boxes just like regular Safety Matches. As the victim tries to light one he gets quite a surprise. **Price 10c per box, 3 boxes for 25c, 12 for 75 cents.**

STAR TOY MAKER

Greatest boys' book written. Tells how to make a Pinhole Camera, a Canoe, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages. 150 illustrations. **PRICE 10c postpaid.**

Wonderful X-Ray Tube

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your finger, the lead in a lead pencil, the interior casing in a pen stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. **Price 10c, 3 for 25c, 1 dozen 75c. Johnson Smith & Co.**

NOSE BLOWER

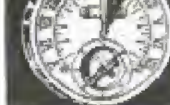
When some men blow their noses it sounds like a trombone. Now the **NOSE BLOWER** has come to torment us. It is a starter! It is ingeniously concealed in the handkerchief. Proceed to blow your nose and your friends will think they heard a trombone or something. You can blame the hideous noise to your having a very bad cold and keep up the fun as long as you like. **PRICE 10c, 3 for 25c, or 75c doz. postpaid.**

Serpent's Eggs

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twirls about in a most life-like manner. **Price per box, 10c postpaid, 3 for 25c**

Combination Sun Watch and Compass

PERPETUAL WATCH
Never needs winding. As true as the sun. Cannot fail or get out of order. Always reliable and correct. No delicate mechanism, no spring to wind or break, no regulating, no cleaning. Gives you the accurate time whenever the sun shines, and that is everywhere. **PRICE ONLY 50c postpaid anywhere.**



Watch Charm Pistol \$1.75



Exact reproduction of a real pistol; actually fires **REAL BLANK CARTRIDGES** of miniature size. Illustration is actual size, 1 1/4 inches long, with ring at end for attaching to watch chain. Loads like a regular pistol. Pull the trigger and it goes off with a loud bang. Pistol in break open type; illustration shows position for loading. Made entirely of high grade steel, nickel plated, octagon barrel, handlessly engraved handles, complete in box with cleaning rod. **PRICE \$1.75.** Also furnished with **pearl handles, \$2.50. BLANK CARTRIDGES, 50c per box of 25.** **JOHNSON SMITH & CO., Dept. 845, RACINE, WIS.**

ARTESIAN DEVIL

A Clever Novelty

Just Press Top and the Devil Dives to the bottom—Let Go and It Comes Up Again. Most Interesting and Amusing

The Devil in the Tube is a most interesting and amusing novelty. There is a glass tube nearly six inches long, a little glass

devil and a rubber cap which fits tightly over the top of the glass tube, effectively sealing it. The tube is filled with water, the glass devil placed inside, and the rubber cap placed over top of tube. All you have to do to make the devil dive is to press the rubber cap with the finger, as shown in the illustration, and the devil immediately sinks to the bottom. As soon as you release the pressure the devil dives to the surface again. Or you can cause him to suspend half way, or even dance up and down in the water inside the tube. The effect is considerably heightened if a colored liquid is used. It is a scientific little curiosity that is well worth having. **PRICE ONLY 25c Postpaid.** **JOHNSON SMITH & CO., DEPT. 845, RACINE, WIS.**

BOYS! BOYS! BOYS! Throw Your Voice

Into a trunk, under the bed, under a table, back of the door, into a desk at school, or anywhere. You get lots of fun fooling the teacher, policemen, peddlers, and surprise and fool all your friends besides.

THE VENTRILO

is a little instrument that fits in the mouth out of sight. Cannot be detected. It is used in connection with the above, and with the aid of this wonderful DOUBLE



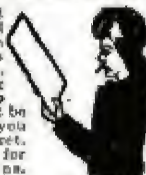
THROAT, or VENTRILO, you can imitate many kinds of birds, animals, etc. Remember you get everything for **ONLY TEN CENTS**—a booklet giving you full instructions how to become a ventriloquist and throw your voice, the Double Throat, or Ventrilo, and our big 600 page catalog of novelties, tricks, puzzles, masks, books, etc., **10 cents**

ALL SENT POSTPAID TO ANY ADDRESS FOR ONLY **10 cents**



INVISIBLE INK Rubber Chewing Gum

The most confidential messages can be written with this ink, for the writing makes no mark. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your guests and other private memoranda away from prying eyes. Great fun for playing practical jokes. Only 15c a Bottle; 3 for 40c.

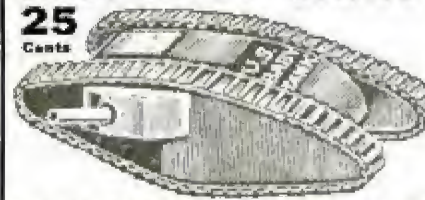


It is just like a regular package of chewing gum and looks so real that it fools everybody. Of course no one suspects it is not genuine until they start to chew it. There's a world of fun in this rubber chewing gum—5 sticks to the package. Price, 10c Pkg.; 3 for 25c; 12 for 75c postpaid.

Rubber Chocolates... Box 25c Rubber Cigarettes. Price per Box. 20c Rubber Dagger... Price 25c Rubber Matches. Price per Pkg. 10c

U. S. BABY TANK

25 Cents



Boys, yet this tank will keep plodding along ten times longer than the ordinary run of toys. It will perform dozens of the most wonderful stunts: 2 1/2 inches long. Price only 25c prepaid. Stamps accepted. JOHNSON SMITH & CO.

It goes with real Yankee Pep—by its own power

Most remarkable toy ever invented. By drawing the Tank back and forth, either with the hand or over the floor or table and then placing it down, it will crawl along, overcoming all obstacles in the same life-like manner as the largest tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys. It is a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys. It is a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys.

THE NEW POTATO PISTOL



This is surely the most ingenious of all air pistols. For ammunition **ALL YOU NEED IS AN ORDINARY POTATO**, and that isn't hard to get. Merely place the point of the barrel of the pistol into a potato, as shown in the illustration, withdraw the pistol and fire. Nothing could be simpler. It fires quite a distance, goes off with a report like all air guns, and there is absolutely no danger. Well made entirely of metal. Price Postpd. Only 35c.

NEW

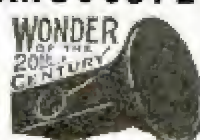
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A great trick by which you can apparently breathe fire from mouth, to the horror and consternation of all. Quite harmless. All apparatus necessary sent complete in box for **ONLY 30c. p. pd.** JOHNSON SMITH

SEEBACKROSCOPE

Place this clever instrument to your eye, you see what is going on behind your back. Very interesting thing sometimes occur when no one thinks you are looking. Just like having eyes at the back of your head. **PRICE 25c POSTPAID**



Send remittance (Postage Stamps accepted) for all articles listed above, also in our other ad on previous page

SQUIRT ROSE

25c



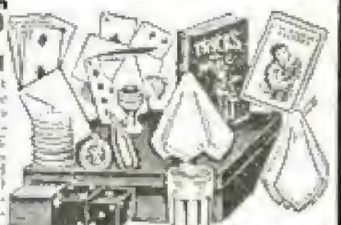
A REAL STARTLER. This is the most popular of all squirt tricks. The flower in your coat looks so fresh and sweet that everyone is tempted to inhale the delightful perfume. Then is the moment to press the bulb. Geese-billkins. Don't they jump! There is a very long rubber tube that easily reaches to the pocket of your coat or trousers, and the bulb is large enough to make a dozen shots with one loading. **PRICE 25c each, or 3 for 65c postpaid.**

MAGICIAN'S BOX OF TRICKS

Apparatus and Directions for a Number of Mysteries Tricks, Enough for an Entire Evening's Entertainment..... \$1.00

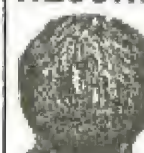
ANYONE CAN DO THEM

It is great fun entertaining your friends. Get this Johnson's Cabinet, and you will be the pleasant fellow to your district. It contains the apparatus for ten first-class tricks, including THE MAGIC BALL AND VASE TRICK (a wooden ball is placed inside, and upon its placing the ball has disappeared and is found in someone else's pocket); THE HINDOO TRICK CARDS can be made to change completely in less than five times; DISAPPEARING COIN BOX is coin, placed in the wooden box, vanishes entirely at command into a coin of another denomination; THE GLASS COFFIN TRICK is coin is dropped into a glass of water and when the water is poured out the coin has vanished and is found underneath; THE SOUTH TRICK is seemingly endless supply of colored paper ribbons comes out of your mouth; the DISAPPEARING HANDKERCHIEF is handkerchief held in the hand mysteriously vanishes; the WIZARD'S RING COIN TRICK; the ENCHANTED BOTTLE (no one but yourself is able to make it lay down); the GREAT BAT AND DICE TRICK is large dice is placed on top of a hat, disappears, and is found underneath yet no one has touched the hat; and last, but not least, the GREAT PHANTOM CARD TRICK, or two from five leaves nothing. Full instructions are sent for performing each trick. In addition to the above, a number of other facts and illusions are fully explained for which you can easily make or procure the necessary apparatus. Price complete \$1.00 postpaid. JOHNSON SMITH & CO.



RESURRECTION PLANT

Great curiosity. Place in water, plant opens up and starts to grow in few minutes. Taken out it dries up and goes to sleep until put in water again. **PRICE 10c, 3 for 25c 75c dozen, postpaid.**



address for only 10c, 3 copies for 25c.

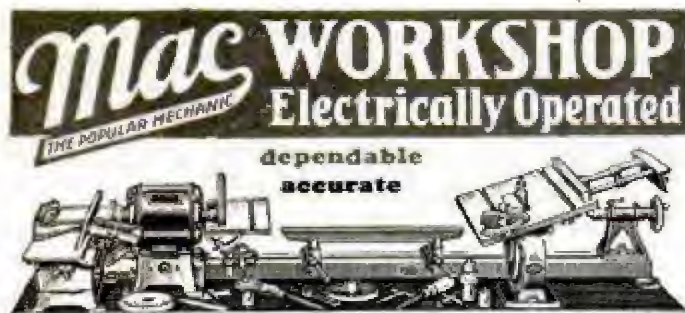
The "Little Giant" Typewriter

A First Class Writing Machine For \$1.50



A perfect little typewriter for \$1.50. There are thousands of persons who would like to use a typewriter but whose needs and business do not warrant the expense attached to the purchase and use of a fifty or seventy-five dollar machine. To such persons we cordially recommend our Little Giant. It is strongly made, but simple in construction, so that anyone can quickly learn to operate it, and write as rapidly as they would with pen and ink. The letters of the alphabet most frequently used are so grouped as to enable one to write rapidly, the numerals 1 to 10, and the punctuation marks being together. With this machine you can send your best girl typewritten love letters, address envelopes, make out bills, and do almost any kind of work not requiring a large, expensive machine. With each typewriter we send a tube of ink and full printed instructions for using the machine. Price complete \$1.50 by mail postpaid to any address in the world.

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AMAZINGLY BETTER WORK SHOP!

Home Mechanics, Inventors, Model Makers, Craftsmen! Now you can expect new things—amazing improvements, new easy ways to make and repair a thousand and one different articles right in your own home. Here is everything you need to gratify your creative instincts—and to make big money, too. Even in unskilled hands results are surprising. MAC is a strong, sturdy, practical workshop—designed to perform the most difficult feats of woodcraft.

Now Sent on 10 Days' FREE TRIAL!

We'll gladly send you this superb craftsman's shop on approval for 10 days' FREE TRIAL. Embraces everything necessary for a complete motorized workshop. 1.3 H.P. Motor; 8-inch Circular Saw; 36-inch Lathe; 4-in. Jointer; Sturdy Jig Saw and complete accessories for all woodworking operations. Guaranteed to give the highest degree of service. Never before has machinery of this character and quality been offered at such amazingly low prices.

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Complete outfit shipped to you on approval. 10 days' Free Trial. Then convenient monthly terms if you decide to keep it—as low as \$5.94 per month. The things you make will be worth many times the small monthly payments.

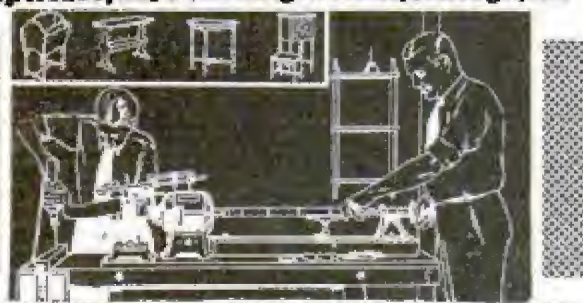
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We'll help you to develop your mechanical talents. A complete service, including instructions and plans, is given. It is simple to master the art of wood turning. In a short time you can become an expert cabinet maker.

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The K-S Telegage is the leading hydrostatic gauge used to measure the liquid contents of large or small tanks at a distance.

Experience not necessary. We teach you how to sell the K-S Telegage. Write today for full details of our selling plan. Address Sales Manager, Industrial Department, King-Seeley Corporation, 314 Second Street, Ann Arbor, Mich.

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We furnish you with all the parts cut perfect. No trouble to fit them together and in a very little time you will have a beautiful ship model that you will be proud to own, placed on your radio or mantel and lighted with the electrical equipment that comes with each model. They give the effect of a ship at sea sailing along on the quest of adventure.

We have the following models, all parts cut to fit and ready to be put together, a complete diagram and instruction sheet numbered so that you cannot go wrong.

Flying Cloud... 26 1/4" long, 7 1/4" wide, 19" high.
Santa Maria... 27" long, 10" wide, 25" high.
Mayflower... 30" long, 10" wide, 26" high.
La Pinta... 27" long, 12" wide, 26" high.
Constitution... 32" long, 10" wide, 30" high.

Every Model Guaranteed Money Back If You Want It

We will send you any of the above models C.O.D. anywhere in the United States. Money order or check must accompany all foreign orders.

All models shipped same day as order is received.

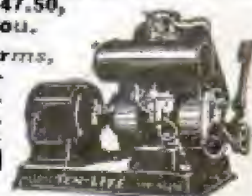
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Ideal for Farms, Camps, Summer Homes. Also runs Household Electrical Appliances. Install it yourself. Write for circular.

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Making Amazing Demonstration

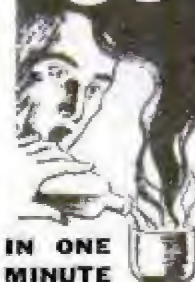
Commission checks for all money due mailed every Saturday to our men. Work full or spare time making amazing demonstration that will save prospects thousands of dollars.

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We will furnish outfit for sensational demonstration. No investment for stock—no deliveries or collections. Every one a prospect. Show in homes, stores, garages, schools, offices, and to farmers, etc. Many of our men now making \$300 to \$600 a month. Write at once to

FYR-FYTER COMPANY

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IN ONE MINUTE

Ten of these sensational demonstrations a day should pay you \$50 a week. No experience necessary—we show you how.



Tobacco Is Hurting You

Look the facts square in the face, Mr. Tobacco User. You may think tobacco is not hurting you.

That is because you haven't as yet, perhaps, felt the effects of the nicotine poison in YOUR system. For you know that nicotine, as absorbed into the system through smoking and chewing tobacco, is a slow working poison. Slow, yes—but sure.

Tobacco lowers efficiency. It slows a man down. Makes it harder to concentrate the mind on work. Tobacco users seldom have the amount of "pep" and energy of those who do not use the weed. There's many a man older than you in years who is younger in energy, simply because he lets tobacco alone.

Some day, probably, you will realize to what an alarming extent tobacco does undermine the system.

When your hands begin to tremble—
and your appetite begins to fail—
and your heart seems to "skip a beat" now and then—
and slight exertion makes you short of breath—
then you have a right to suspect that
TOBACCO is getting the upper hand.

Any well-informed doctor will tell you that these are only a few of many symptoms of tobacco poisoning.

And YOU know that the use of tobacco in any form is an expensive, utterly useless habit. You know you ought to quit.

Tobacco Habit Banished Let Us Help You

It doesn't make a particle of difference whether tobacco has been used for a single month or fifty years, or how much, or in what form—whether cigars, cigarettes, pipe, plug, fine cut, or snuff. In most cases, Tobacco Redeemer removes all craving for tobacco in any form in a very few days. Not the slightest shock to the nervous system. The tobacco craving will usually begin to decrease after the very first dose—there is no long waiting for results.

Tobacco Redeemer contains no habit-forming drugs of any kind and is quick, safe, pleasant and thoroughly reliable.

It is in no sense a substitute for tobacco. After finishing the treatment, there is usually no desire to use tobacco again or to continue the use of the remedy. It helps to quiet the nerves and makes one feel better in every way.

Results Guaranteed A single trial will convince you. Our legal, binding, money-back guarantee goes with each full treatment. We will refund every cent you pay for the treatment if, after taking it according to the easy-to-follow directions, it should fail to banish the tobacco habit completely.

SEND Coupon for Free Proof Let us send you our free booklet on the injurious effects of tobacco, together with testimonial letters from men all over the country telling how they have been absolutely freed from the tobacco habit by this simple home treatment. You could not ask for stronger proof that Tobacco Redeemer does do the work than the evidence we will gladly send on request. Just mail the coupon—or a postal will do.

NEWELL PHARMACAL CO.

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Free Book Coupon

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Build POWER AMPLIFIERS Like this!



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the New and
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Sprays paint, lacquer, varnish, disinfectants, insecticides. For use in the home, factory, garage, dairy, farm, sign shop, boat yard, greenhouse, etc.

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in model aeroplanes. If you install a superpowered motor, with mechanical controls, made according to our directions your model airplane will make perfect loops, tail spins, dive, zoom, fly figure 8, circles or any other maneuver same as high powered army pursuit plane. Motor can be made by anyone, nothing complicated. Will work successfully in any flying model plane. Complete directions and drawings 50 cents coin. No stamps. Superior Machine & Mfg. Co., Albert City, Iowa



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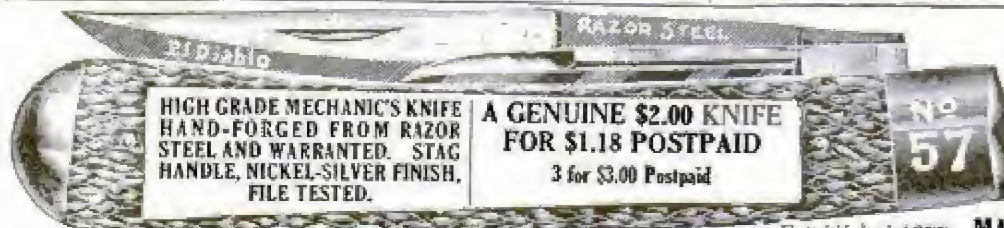
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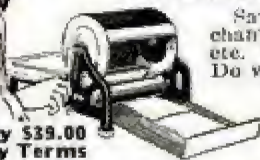
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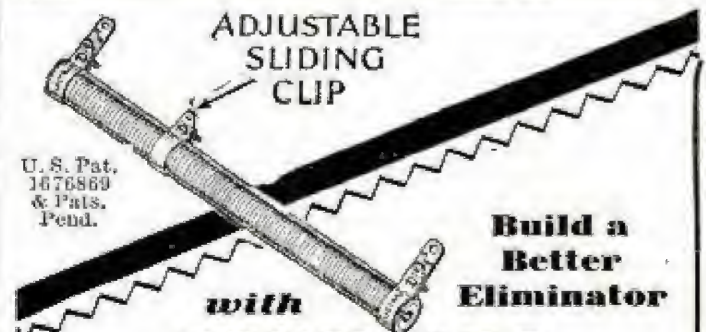
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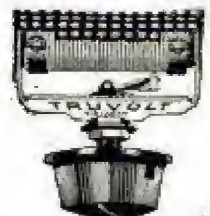
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11 W. 42nd St., New York 265 Market St., San Francisco
Consult telephone directory for branch addresses in other cities

J. D. WALLACE & COMPANY,
Adams St. at California Ave., Chicago, Ill.
Please send me full information about the Workace Electric Woodworker and also the Workace Machines checked below.

☐ Workace Jig Saw ☐ Workace Band Saw
☐ Workace Shaper ☐ Workace Planer ☐ Workace Radial Saw

Name

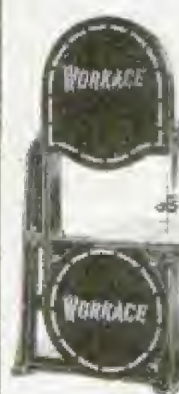
Address

City.....State.....

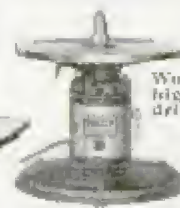
\$9.00 DOWN
\$89.00 COMPLETE

**Mail
Coupon Above**

5 FEET

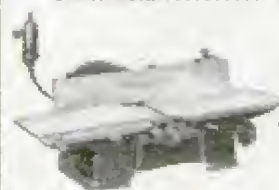


Jig Saw Attachment for the Workace Electric Woodworker... \$10

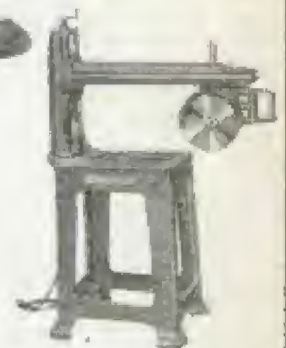


Workace Electric Shaper—high speed, direct drive, portable..... \$95

14 in. Workace Band Saw, fast, accurate, geometrical..... \$75



Workace Portable 4 in. Planer... Complete with motor \$25



Workace Radial Saw, Saws at any angle..... \$140

Cast Iron Table \$10 Extra
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- ☐ Mechanical Drawing
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- ☐ Architectural Draftsman
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- ☐ Contractor and Builder
- ☐ Structural Draftsman
- ☐ Structural Engineer
- ☐ Electrical Engineer
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- ☐ Electric Wiring
- ☐ Electric Lighting
- ☐ Electric Car Running
- ☐ Telegraph Engineer
- ☐ Telephone Work
- ☐ Civil Engineer
- ☐ Surveying and Mapping
- ☐ Bridge Engineer
- ☐ Gas Engine Operating
- ☐ Automobile Work
- ☐ Aviation Engines

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- ☐ Blacksmithing and Forging
- ☐ Patternmaking
- ☐ Foundrywork
- ☐ Machine Shop Practice
- ☐ Plumber and Steam Fitter
- ☐ Plumbing Inspector
- ☐ Foreman Plumber
- ☐ Heating and Ventilation
- ☐ Sheet-Metal Worker
- ☐ Steam Engineer
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- ☐ R. R. Positions
- ☐ Highway Engineer
- ☐ Chemistry ☐ Pharmacy
- ☐ Mining Engineer
- ☐ Navigation ☐ Assayer
- ☐ Iron and Steel Worker
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- ☐ Cotton Manufacturing
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Heavy starting duty, 110 Volts, 60 Cycle Single Phase, 1725 Speed, General Electric Repulsion Induction MOTORS in original cartons.

1/4 H. P. only \$13⁵⁰



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These motors were built by the G. E. Co., for a concern that failed before delivery could be made. We purchased 1500 of them at a very low price. You can buy one or more at prices quoted above until stock is exhausted. Furnished with feet or rubber cushion base. Shaft diameter 3/4 inch. Pulleys 75c extra. Grinding and buffing attachment spindle \$1.95. Six inch by 3/4 grind wheel \$1.75. Cotton Buffing Wheel 60c.

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The only high-grade watch
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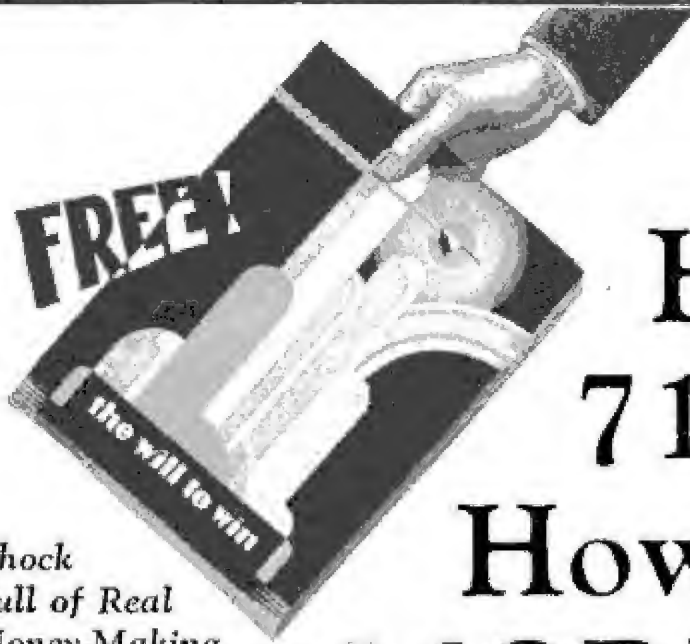
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An amazing NEW Scientific Vapor Humidifier and GAS SAVER has been patented throughout the World that beats anything ever gotten out before. It makes engines run ALL THE TIME with the same wonderful efficiency they do on a cool moist night. It gives MORE pep and power—HIGHER top speed—automatically ELIMINATES hard carbon from engine—and causes engine to give AMAZING MILEAGE RECORDS NEVER EQUALLED BEFORE.

ENTIRELY UNLIKE ANY OTHER DEVICE. This startling invention is radically different from every other kind. It uses MOISTURE from the radiator and makes the car run like on a damp cool night. It is GUARANTEED to save from $\frac{1}{4}$ to $\frac{1}{2}$ the gas and oil, stops boiling and steaming, makes engine start easier in all kinds of weather, and completely de-carbonizes the engine as you run.

This new principle device has been extensively tested out by Technical Engineers and Experts and found to give vastly more mileage, with largely increased power and pep from the engine. With it the engine used approximately 90% air, 6% moisture and ONLY 4% of gas.

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\$350 to \$1500 a month

1 man \$4,939.66 in 3 $\frac{1}{2}$ months
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One man sold 8 first morning
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Successful VIX men make MORE MONEY
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Try this wonderful VIX Moisture Humidifier and Carbon Eliminator AT MY RISK on YOUR OWN CAR to prove that VAPOR MOISTURE (drawn from Radiator to Engine) gives you that wonderful night driving effect ALL THE TIME with MORE mileage from gas and oil—eliminates hard carbon accumulation—gives MORE power, a SNAPPY, PEPPIER motor, FASTER acceleration, a SMOOTHER, QUIETER running engine and HIGHER top speed.

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This Year Give Yourself
Lifelong Fun
Profit and
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What greater gift can you confer on your children this year than lifelong fun and entertainment?

Love of music means love of home, an appreciation of the finer things in life. Here is a chance to give your boy or girl that love without the tedious practice that most instruments require. The Xylorimba is easy to play. No teacher is needed. Practice is actually a joy.

Remember, the Xylorimba is the guaranteed product of a company established nearly half a century ago—a company that stands back of every promise it makes.

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Haven't you, like millions of others, envied the fellows who "bring down the house" with snappy xylophone or xylorimba numbers? Haven't you longed to create your own music, to be looked up to wherever you go, to be able to make real money in spare time? If you have, this ad spells O-p-p-o-r-t-u-n-i-t-y. The xylorimba—wonderful for home, in demand at dances and gatherings—is nevertheless *the easiest of all instruments to play*. In fact, on the very day you get yours you play simple melodies, even if you can't read a note of music right now. In a few weeks you astonish your friends and family. *All your life* you have the joy that comes to those who can entertain.

Plays 20 Minutes; Gets \$20!

Ralph Smith, Chicago, played twenty minutes at wedding; his "pay" was \$20. Altho only 12, Turk McBee, Jr., plays big-time vaudeville exclusively. Harry Breuer, New York, has

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And now J. C. Deagan, Inc., (world's largest manufacturer of xylophonic instruments) has made it so easy to own a xylorimba that nothing stands in your way. Sizes and styles to fit every age and pocketbook. A five-day free trial that eliminates risk. Free, easy lessons that make teacher unnecessary—and, best of all, such easy payments that they are hardly noticed.

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Everyone wants to be popular. Everyone wants to make extra money. Everyone wants to be *center of attraction* at gatherings. But these advantages don't come by themselves. Opportunities must be seized. This is *your* opportunity—will you pass it up without investigation? The accompanying coupon will bring our big FREE book to your door. It tells all about the Deagan line, the free trial, the easy payments. Remember, no cost or obligation! Simply fill in and mail the coupon—but do it before it slips your mind. Today is as good a day as any. Do it NOW!

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Please send me full details on the Free Trial offer and easy payment plan of the Deagan Xylorimba.

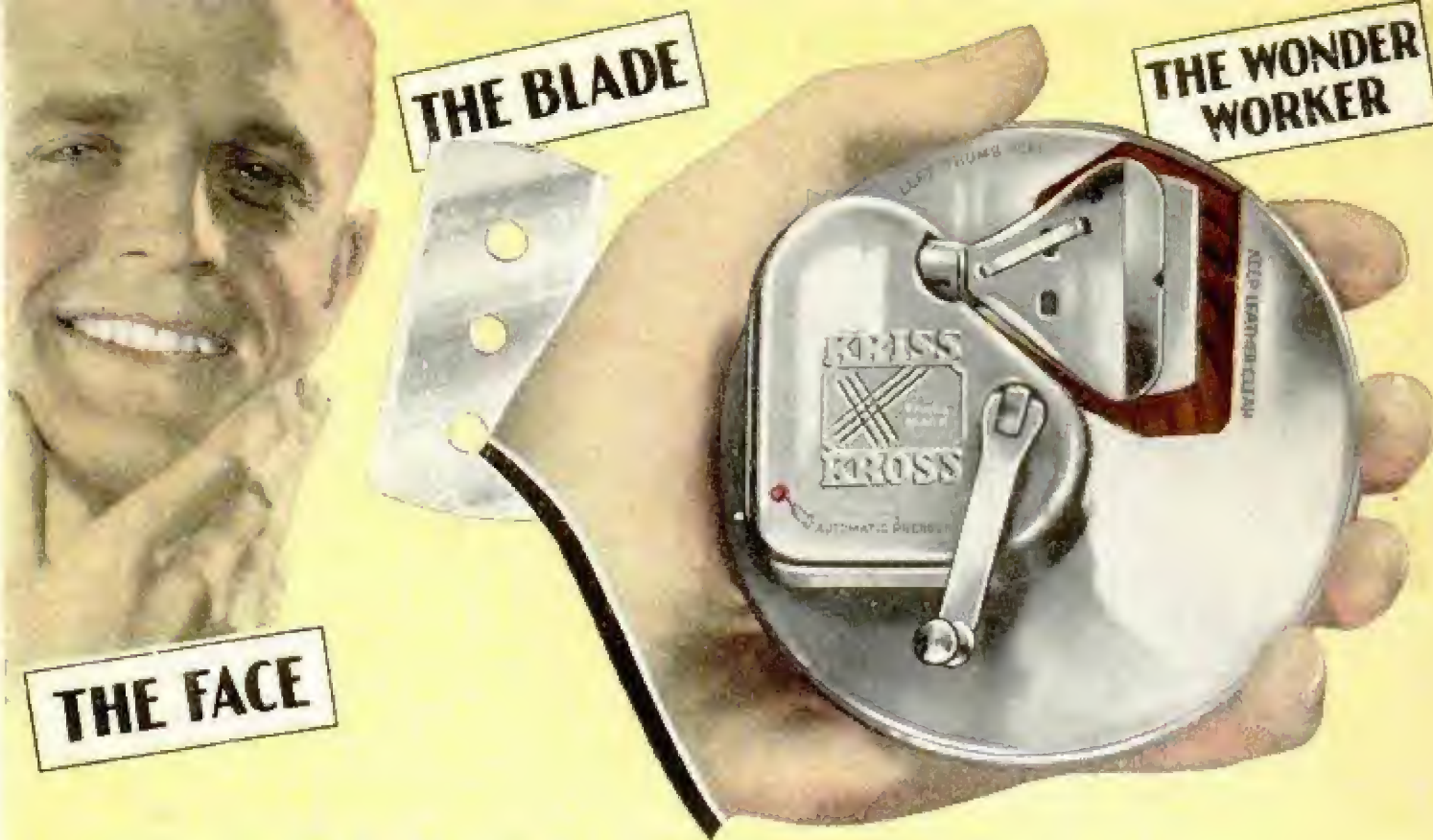
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365 Shaves With the Same Blade! —and Still Going Strong

THINK of it! 365 keen, cool shaves a year—and not one penny for blades during the whole time! That's what an amazing new shaving invention did for J. W. Starksbury of Oklahoma! And W. D. Carroll of Pennsylvania got two solid years of sleek shaves out of an old blade that was just about worn out to begin with! No wonder experts everywhere are simply astounded!

KRISS KROSS—the remarkable invention that makes such long-distance shave records possible—deserves to be called much more than a stropper. Rather it is a *super-stropper* or blade *rejuvenator*. Almost literally, it makes a new blade out of an old one every day—makes hundreds of keen, quick shaves blossom where only one grew before. Until you've seen KRISS KROSS and tested its uncanny ingenuity, you'll never know how really sensational it is!

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KRISS KROSS employs the diagonal stroke, same as a barber uses. Never before has anyone captured the secret of reproducing this stroke automatically. Eight "lucky leather grooves" do the trick in 11 seconds with a precision it takes a master barber years to attain.

But that's not all. KRISS KROSS embodies still another feature that has hitherto baffled mechanical reproduction. It drops from *heavy to light*. It's absolutely uncanny the way the strokes grow lighter and lighter until an adjustable, automatic jig flies up and notifies you that your blade is ready—ready with the keenest cutting edge that steel can take!

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